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Electric Railways

The Fuel Economy Aspect

As the tonnage of coal used by British railways before the war was not far short of one-tenth of that supplied to the home market, it was to be expected of the companies that they should carefully consider what contribution they could make towards reducing the ratio of coal needed to the quantity mined. Hence the recent series of conferences of railway engineers, the fourth of which related to electrified lines. From information presented in the two papers by Mr. W. J. A. Sykes (Southern Railway) and Mr. W. A. Watt (L.P.T.B.), which were reported in our last issue, and from the ensuing discussion, it would appear that any margin for retrenchment on such railways is necessarily very limited. This is not surprising since proposals for a change to electric working, in order to justify the capital expenditure, have to take full advantage of all possible savings in fuel as well as in the operating labour and maintenance costs that can confidently be anticipated.

Maintained Efficiency

Data from the Southern Railway seem to indicate that a reduction in the number of kWh used has been obtained only as a result of the lower car mileage now worked and of some saving in the heating and lighting of passenger coaches. Indeed, considering that the trains cannot be run under anything like the designed conditions, to have secured approximately the same consumption per car-mile is in itself an achievement, though it has not been accomplished without great strain, human and material. Similarly in regard to power stations, where combustion efficiency has been kept at a high level with variable and poor coal. What all this has meant in labour diverted to maintenance is another matter.

Conversion Justified

The spirit of the meeting left no room for doubt that if anything more could be done to meet the immediate emergency it would be done. Looking further ahead, it is improbable that the conclusion of hostilities will see an end to the need for thrift in the use of fuel. Apart from the fact that the country's coal resources are a diminishing asset, the better qualities available will be required for special purposes and for export to help to pay for imported necessities. Even if electric power stations burned more coal of a low grade per HP delivered to the driving wheels than steam locomotives do of large coal (instead of about one-third), electrification would be desirable.

It seems anomalous that so large a proportion of the power required for traction should be produced by small local prime movers, instead of by centralised generation with its recognised advantages. The splendid performances put up by British steam locomotives cannot offset their inherently low thermal efficiency, and the sixteen million tons of mostly high-quality coal burned annually for rail transport could be reduced, through electrification, to about six million

tons of a kind for which there is little other demand. Conditions are likely in the future to be much more favourable to complete electrification than they were in 1931, when the Weir Committee, on a number of grounds, recommended such a course, which it showed would yield a reasonable return on the capital expenditure incurred in the change-over. The Committee could not foresee developments that would have added so materially to the force of its arguments by assigning a greater proportionate value to fuel than to capital charges.

Reinstatement

EVERYBODY agrees that the nation will be doing no more than its duty in ensuring, so far as is possible, that men and women returning from the Services to civil life, shall be no worse off for their absence from their jobs. The vast majority of employers are ready and willing to take these people back at the earliest opportunity, but there must be many cases in which this will be impossible. Many firms have closed down ; others will be in extremely different circumstances. There may be instances, however, in which employers, although in a position to do so, will try to evade their obligations. It is to these, very few we hope, that the compulsory powers of the Reinstatement in Civil Employment Bill will be applied. In all other respects the measure will be extremely difficult to operate in spite of the elasticity apparent in many of its clauses.

Kitchen Planning

MUCH thought is being devoted to the design of the kitchens of the millions of houses which will have to be built after the war and it is very proper that this should be so. A considerably greater proportion of the cost of a house would be well spent in providing a better room than has been common for the carrying out of the many household operations. At the same time it will not do to be over-ambitious, for the cost of houses must remain within reasonable limits. From what we have seen of the designs for new equipment produced by electrical manufacturers in co-operation, the housewife will have available compact, efficient and moderately-priced electrical appliances. These are what she really needs and efforts must be made to see that most of the allocation for the kitchen is not absorbed by less essential " gadgets " and trimmings.

Ring Main

IN this issue Mr. Forbes Jackson summarises the more important of the issues regarding domestic installations that have been raised in our columns during the past few months and adds his own comments based on a wide experience of what the public needs. Accepting the ring-main principle, he shows that there are a number of details still to be agreed upon among installation engineers. Two of his conclusions are not likely to be disputed. One is that the immediate present offers unparalleled opportunities for making changes in the technique of the past. The second relates to the touchstone of all electrical progress—that the over-riding consideration shall be the interests of consumers.

Last Year's Work

ACTIVITIES in the production of standard electrical plant and apparatus in 1943, which form the subject of some notes in this issue, have been paralleled by researches in many directions. Apart from those which must still be regarded as " secret," much has been done in investigations into the suitability of alternative materials and the control of manufacturing processes. Taking both aspects into account, the intensive testing of results provided by the ardous conditions of the war could have been achieved only after many years of experience in ordinary circumstances. Its fruits are manifest to some extent now and will surely be of permanent value for the future.

Argentine Exports

RECENT events in Argentina have raised conjectures as to the immediate effects of the changes there, and as to the future of trading relations between the Republic and this country. But, quite apart from the revolution, the war has had a profound effect upon the economic structure of Argentina. Inability to obtain many classes of manufactured goods has forced the country to set up plants for their home production, and in many directions these have fully met the needs. Further than this, there has actually been a surplus of many

products which have been exported to neighbouring States. During the first ten months of 1943 the value of exported manufactured goods rose by 95·6 per cent. as compared with the corresponding period of 1942 to a value of 352 million pesos (about £20 million). Details are not yet available to show how much of this total represented electrical goods, but in the preceding year exports of these were valued at about 5 million pesos (approximately £300,000).

Representatives' Attitude

REFERRING recently to this expansion of Argentine manufacture, the *Review of the River Plate* supported a suggestion made at a meeting of the British Chamber of Commerce in Argentina that "if British trade representatives in this country are going to view their function and purpose in terms of a narrow *importing* exclusivity they are in danger of doing a serious disservice to in the first place themselves, secondly to the higher conception of British trade representatives abroad, and thirdly . . . to the good relations . . . between Great Britain and the country where they make their living and their profits." Our contemporary considers that "no British trader who sees a locally manufactured product, which he formerly imported, gain a firm foothold in the local market, can afford to turn his back on the product if there is a chance of his being able to handle it on reasonable terms." We may express the hope that opportunism will not entirely smother the primary purpose of British agents in Argentina—the sale of British goods.

Bathroom Deaths

THE serious increase in the number of deaths due to the use of electric fires in bathrooms necessitates some kind of national action. Many of these fatalities are caused by defective appliances, either old ones or the new ones which are still too easily obtainable. Others are attributable to badly patched up extensions of flex. It is impossible to prohibit the use of fires in bathrooms, or to enforce any prohibition, and in any event it might be undesirable. But it is quite feasible to warn the public of the possible danger. They should be told that only fires mounted on the ceiling or high up on a wall away from the bath can be considered absolutely safe. The B.B.C. might be asked to broadcast occasional statements on the subject, care being taken that these did not give the false impression that electrical appliances, as such, were dangerous. This slur on the industry should be eliminated.

Furnace Transformers

IN the leading article in our last issue reference was made to the construction last year of shell-type transformers, delivering 30,000 A, that were intended for use in conjunction with electric furnaces. While these are good examples of heavy-current work, it might be stated that they do not represent the largest currents yet supplied from transformers for this purpose. In an article in the same issue on ferro-silicon production we described smelting arc furnaces in which electrode currents are of the order of 52,000 A, and we understand that no less than 80,000 A is the designed figure for certain transformers which are being used for similar but larger furnaces.

Magnetic Currents

FURTHER particulars will be needed before a value can be assigned to experiments carried out by Prof. Felix Ehrenhaft in New York which he claims, according to *Reuter*, prove the existence of "pure magnetic current." Prof. Ehrenhaft has found that the magnetisation of an electrode in acidulated water results in the evolution of both hydrogen and oxygen, the latter coming from the north pole. Gas bubbles bearing a sign opposite to that of the pole are retained on it, while those bearing the same sign are strongly repelled. A curious feature is that the pole strength of the permanent magnet used was very much weakened. Developments of the possibilities inherent in these experiments will be awaited with interest.

Who Pays?

IN a recent economy poster produced for the Ministry of Fuel and Power for use in factories the words "It Doesn't Matter: The Firm Pays for It" are crossed out and the revised version reads:—"It Doesn't Matter: The Country Pays for It." But too many people still do not realise that they are "the country." Why not "*You* Pay for It"?

Quality Control

The Human Factor

By D. Williams, M.Sc., M.R.S.T.

NORMAL inspection methods are largely impersonal, the inspector being disinterested in the circumstances giving rise to defective work. As quality control may be applied at several crucial points in the manufacturing process, not only to the material itself but also to the operator handling it, it cannot be considered merely as a matter of statistics and their interpretation. It involves personal contacts between the inspector, the operator and the charge-hand and, however sound the mathematical basis of the system, it will not function efficiently unless there is some appreciation of the psychological factors which are involved.

The operator is quick to realise that quality control is, despite its name and novel features, a system of inspection and it is here that we have to prevent an association of ideas which may easily prove fatal to its success. For this reason the introduction of the system into a new department should always be carefully planned.

Early Stages

A start should be made with a small number of operators so that everyone concerned has ample time to deal with the initial difficulties and queries as they arise. In addition, the few have something which the others have not got and this will give them a sense of superiority whilst arousing in the others a certain amount of curiosity and interest which may even result in a request for an extension of quality control to their own work. Whilst this cannot be regarded as an indication of the popularity of the system, the request often being made in complete ignorance of its aims, it helps to eliminate the subconscious fear of the unknown which is often responsible for much opposition to innovation.

One early reaction to quality control is a fall in production. This is almost inevitable, even with skilled operators. Efficiency in any routine job only comes when the essential movements can be made without conscious effort. The very novelty of the system changes sub-conscious actions into conscious ones with a resulting loss in speed. The attempt to ensure that the results recorded on the graph are creditable actually operates in the opposite direction. This phase eventually passes, but it is very important that it should be understood by all concerned with the administration of the system.

Sympathetic consideration at this stage will enable the operator to adjust him- or herself quickly to the new conditions, and experience shows that production soon returns to normal. A quality bonus is sometimes introduced in an attempt to maintain production, but this is best avoided as quality then becomes a separate entity from production and maintains it at the level of conscious action. It is much better for the operator to be " quality-control conscious " rather than " quality conscious." An intelligent interest in the graph and ability to respond to its warnings at the appropriate times is better than an uneasy mind about the quality of the hundreds of parts which the operator handles every hour.

Furthermore a quality bonus throws a double responsibility upon the shoulders of the quality control inspector, whose job is by no means an easy one, calling as it does for tact, patience and accuracy. It is claimed that quality control inspection staff can be recruited from redundant normal inspection personnel, but this is not always a wise plan as it immediately associates the old and new methods, which should be avoided. In addition, the ability to use measuring instruments and to handle materials, *i.e.*, the qualifications for ordinary inspection, is not enough. Quality control makes the same demands, but requires the additional and more exacting qualification of being able to handle human beings.

The operator will naturally be sensitive about a graph which advertises to all and sundry that the quality of his or her work is below standard, whilst the charge-hand, worried about labour and maintenance difficulties, rates of production, supplies of material and future deliveries, can easily think of many good reasons why the quality of the work cannot be improved. Between operator and charge-hand the inspector must be neither intimidated nor aggressive. Such persons are difficult to find but the effort is well worth while.

Stage Lighting

THE development of stage lighting, with a comparison of British, Continental, American and Russian methods, was described by Mr. L. G. Applebee, manager of the theatre lighting department of the Strand Electric & Engineering Co., in a lecture before the Bristol Branch of the Association of Supervising Electrical Engineers on January 7th. Speaking on " Coloured and Directional Light as Applied to the Stage," Mr. Applebee demonstrated effects of " coloured light " on various pigments, and showed slides of actual theatrical productions and apparatus.

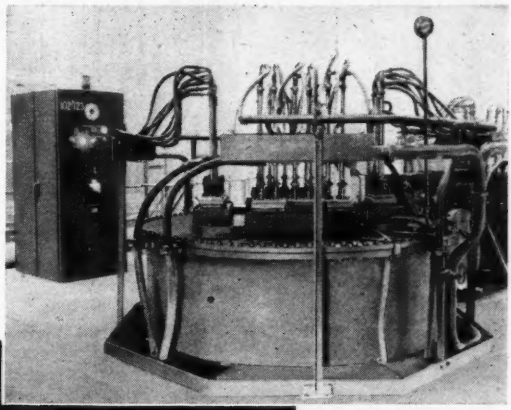
Making Magnesium

Distillation in Electrically Heated Retorts

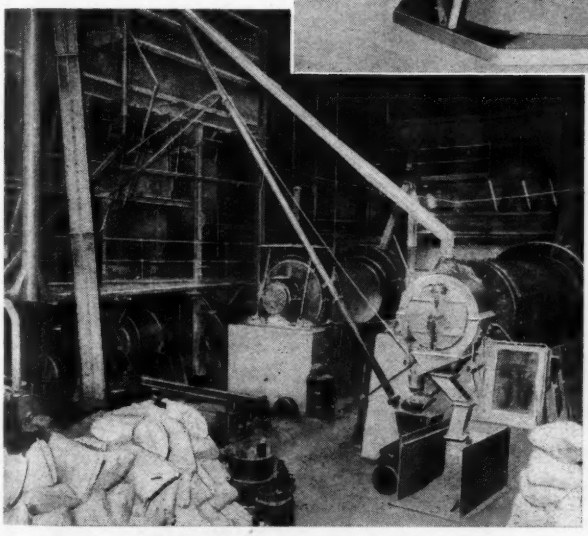
THIS article relates to the processes involved in the production of magnesium as we saw them carried out recently in specially designed plant, with particular reference to the electrically heated furnace-retorts in which distillation is effected on the thermo-reduction principle. The raw materials are powdered aluminium which is prepared in a special section of the factory plant, and magnesium oxide which is produced elsewhere from sea water by precipitation.

In the aluminium plant ingots are first melted in coke-fired furnaces and the molten metal is introduced to pouring boxes which it leaves as fine streams at the entrance to a collecting chamber. High-pressure air jets impinge on these fine streams of metal, with the result that the aluminium is atomised and blown into the collecting chamber as very fine powder. This is then dealt with on an electrically driven agitator screen and finally bagged ready for delivery to the preparation plant in the magnesium factory proper.

In the preparation plant the magnesium oxide is conveyor-fed from storage bunkers to rod and compound tube crushing mills. The powdered aluminium and the crushed magnesium oxide are then introduced in the required proportions to mixing plant *via* scale hoppers and by means of pneumatic suction plant and chain conveyors, and after intimate mixing the material is passed on to briquetting presses in which it is compressed into tablets up to, say, about three inches in diameter and one inch thick ready for treatment in the distillation furnaces. There are a few different types of briquetting presses, and one of particular interest is the hydraulic press in which the tablets are compressed and rejected upwards from the cups in a revolving horizontal table. The entire operation is oil-hydraulic, the pressure being provided by a compact motor and pump unit with a common frame. The whole of the prepara-



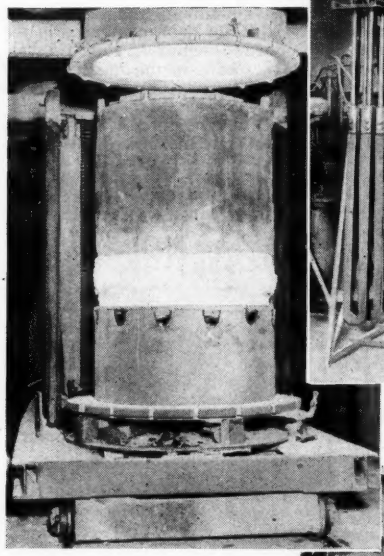
Each intermittent furnace is vertically disposed so that about half of its length projects upwards from the operating floor

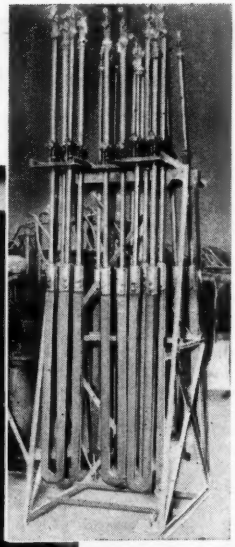


The whole of the preparation plant is electrically driven; crushing mills right, mixing equipment left

tion plant is electrically driven and it embraces some excellent examples of power-transmission schemes, but our primary object in this article is to direct attention to the electrically heated distillation equipment.

Two types of distillation retorts





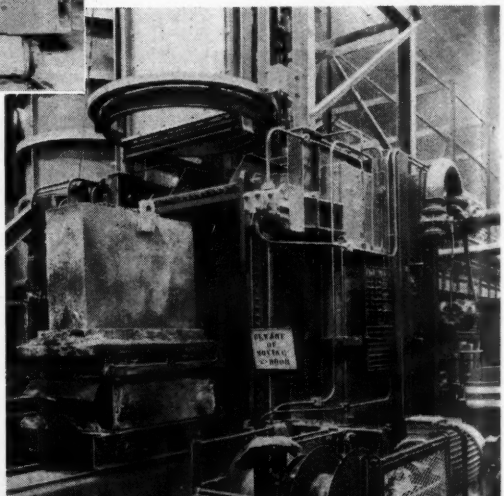
Left: Long U-shaped carbon elements are bolted to and suspended from water-cooled tubular connectors. Below: The charge set-up is hand-pushed into the annexe of the continuous retort and then pushed by a ram to the far end

For charging, the hydraulic-hoist bogie with its charge set-up is placed immediately under the entrance and exit portal of the intermittent retort

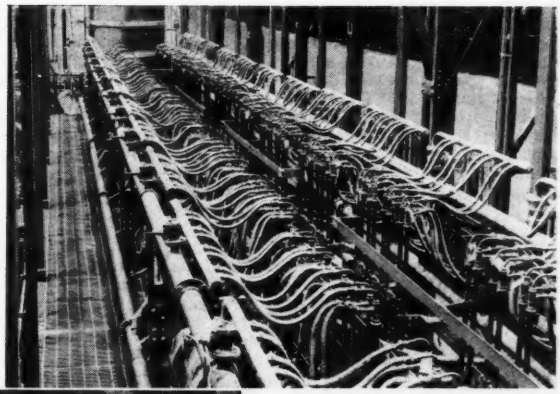
are employed—intermittent and continuous—but the set-ups of the charges are similar, although the methods of introduction to the furnaces are different for purely physical reasons. The briquettes are packed into a crucible which surmounts a condensing box. The magnesium leaves the crucible as vapour and while still in the furnace it condenses in the box at the bottom as crystals of very pure metal.

The construction of the intermittent furnaces is very simple, each equipment consisting of a steel cylindrical shell about 7 ft. in diameter which is lined with refractory brickwork. The elements just hang from the furnace top, so that they are disposed near the inner face of the refractory and around the charge when this is in position. The cylinder is about 6 ft. long and it is vertically disposed in such a position that about half of its length projects upwards from and about half downwards from the operating floor. From the bottom of the main cylinder is a short central extension of smaller diameter which constitutes the charging and discharging portal of the furnace. At the flanged bottom of this portal is a steel door which is bolted to the flange, thereby hermetically sealing the furnace when it is charged. The door is about 10 ft. above the ground-floor level.

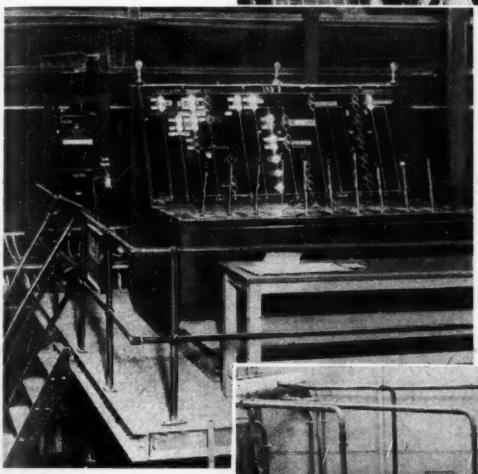
A number of these furnaces are arranged in line, and immediately below them on the ground floor is a double rail line along which runs a



specially designed bogie carrying a hydraulic charging and discharging hoist. The bogie is man-handled and it can be pushed into the required position for charging or discharging under any one of the furnaces. For charging, the door of the furnace is first placed on the hoist loading platform and on this door the charge set-up is then built up, the charged crucible having first been preheated in a gas-fired furnace. The hoist is self-contained with its motor-driven oil-hydraulic pump,



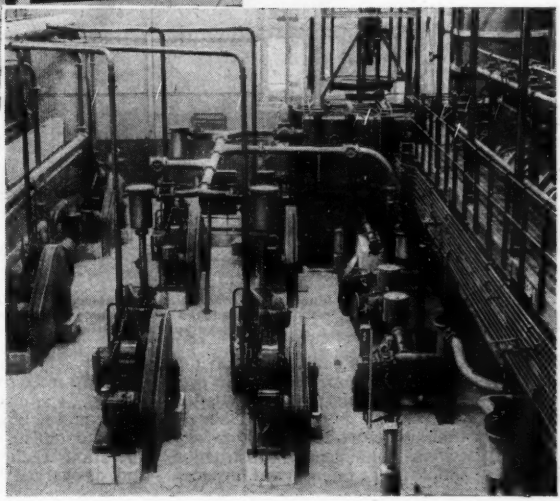
Access to the electrical and water connections is afforded by means of two catwalks right along the top of the continuous furnace



Above: All the continuous-furnace hydraulic operations are actuated by solenoid valves controlled by lever switches from a central control board

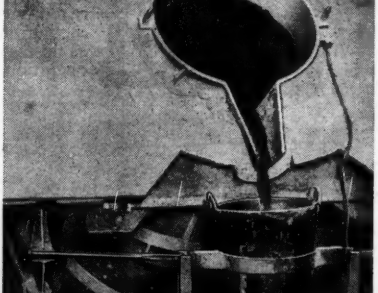
Right: For creating and maintaining the vacuum in both the intermittent and continuous furnaces there are many vacuum pumps with fine examples of V-belt transmissions

and the motor is supplied by means of a trailing cable which is plugged into any of a number of points on the building stanchions alongside the track. When the charge set-up is raised completely into the furnace the door is bolted and the hoist is then lowered and pushed away. For discharging operations the above procedure is reversed. As soon as the furnace is sealed a vacuum is created in the distillation chamber; although mainly for process requirements this has a definite electrical advantage, in that the life of the elements is prolonged by the elimination of the burning which would take place as the result of the high-temperature operation in air.



Carbon elements are employed in the retorts, each element taking the form of a long " U," about 3 ft. from top to bottom. The carbon is about 2 sq. in. in cross-section, and the spacing between the two arms of the " U " is about 2 in. The tops of the carbons are bolted to copper connectors from which they are suspended by long water-cooled tubular conductors which project about 2 ft. from the top of the furnace, suitable insulated glands being provided at the points of entry into the furnace. As they hang in the furnace the carbons just about take up the full length of the distillation chamber. Carbon is chosen as the heating element material to withstand the high operating temperature. The life of the carbons varies considerably, but there is evidence that, as the result of experience, this appears to be settling down to about, say, 100 charges. The carbons are tested on load periodically for breakages by means of a specially designed but simple insulated testing rod equipped with a double-contact arrow-shaped end and a voltmeter. Insertion of the arrow between the two projecting arms of an element makes electrical contact with both arms, and the volt-drop reading indicates carbon breakage or otherwise.

There are twelve elements fitted in each furnace, giving a total loading of about 250 kVA. These twelve elements are arranged as two single-phase circuits with the six elements of each circuit in series. The " overall " operating voltage for each circuit is 100, but the variable heating requirements in the distillation chamber are afforded by voltage regulation. For this purpose there is for each furnace a manual operating panel equipped with, *inter alia*, a selector switch by means of which suitable contactors that select the required operating voltages are actuated. The actual voltage variations are obtained from tappings on the furnace transformer.



Finally the magnesium is melted down for refining in standard high-frequency furnaces with motor-operated tilting gear

At present all the intermittent furnaces are controlled individually as described, but a scheme has been projected for the control of the whole installation from a central room.

The continuous retort furnace is a very much larger affair, but in general construction it is just as simple as the intermittent furnaces. In the main it consists of a refractory-lined steel shell about 175 ft. long and 10 ft. in diameter which is disposed horizontally. Bogies carrying the charge set-ups which are similar to those of the intermittent furnaces, except that the crucibles and condensing boxes are rectangular instead of cylindrical, travel on rails throughout the complete length of the furnace. They are pushed in at the charging end one at a time, periodically, and the push is transmitted from one bogie to the next throughout the entire train, so that as each new charge enters the furnace a distilled charge is pushed out of it at the discharge end. It takes about 30 hours for a bogie to travel from one end of the furnace to the other, *i.e.* to complete the process.

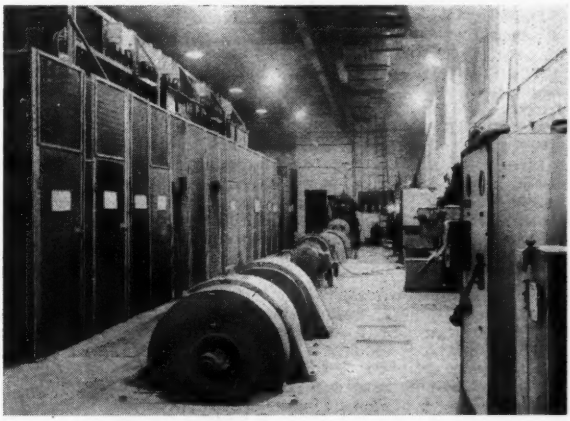
Because of the continuous - operation character of the furnace there are special constructional features to maintain the vacuum during the charging and discharging operations. This is effected by a system of double doors at each end where there is a short annexe at right angles to the main body of the furnace. There are an inner door at the end of the furnace proper which opens out to the annexe interior, and an outer door at the side of and near the " free " end of the annexe which opens out to atmosphere. They are both hydraulically operated sliding lift-up doors, and the inner one is raised within a cylinder which extends upward from and seals the main body of the furnace. Both doors cannot be opened at the same time, of course.

With the inner door closed the charge set-up is hand-pushed into the annexe and then pushed by a hydraulic ram to the far end of the annexe to just outside the inner door. Then, with the inner door only open, another ram pushes the charge set-up into the retort proper and all the other bogies " move up one."

The operations are similar at both ends of the furnace, except that at the discharge end the hydraulic propulsion is pull-out instead of push-in, and they are precisely related with regard to timing. The charge set-ups are lifted on to and from the bogies by overhead cranes.

In a complete sequence there are about 20 operations each time the furnace is charged and discharged with one bogie and set-up,

such as doors opening and closing, actuating charging rams and creating vacuum. They are all hydraulic with electrical control, a hydraulic valve in each case being actuated by a solenoid by means of a lever switch at a central and elevated control board from which the operator commands a view of both ends of the furnace. Although all the operations are effected manually, they are all arranged as a definite system of electrical sequence control by means of adequate interlocking between the solenoids. Further, the central control board carries indicating lamps for all the operations, and these are actuated by limit switches that are fitted to the doors, bogies, etc. A central motor-driven pumping installation, complete with a pressure accumulator, serves for all the operations, and for creating and maintaining the vacuum in both the intermittent and continuous furnaces there are many vacuum pumps with some fine examples of V-belt transmissions.



The high-frequency furnaces are supplied at 200 cycles from M.G. sets which, with their power-factor correcting condensers and control gear, are installed in a separate room

Distillation Chamber

There are ten heating zones in the distillation chamber and each zone is served by a 200/300-kVA transformer which supplies the zone elements as a 400-V balanced three-base system in star connection. In each case there are four or eight elements in series on each phase, and each zone is separately controlled.

Thermo-couples in the zones operate in conjunction with recording instruments on the central control board.

The elements are of similar construction to those of the intermittent furnaces and they are suspended from the furnace top in two lines throughout the length of the distillation chamber, so that the charge set-ups travel centrally along the chamber between the two lines of elements. The water-cooled connector rods project upwards from the furnace top, and the series connections for the individual elements and the star connections for the phase groups are arranged by means of heavy copper clamps and bus-bars. Access to the electrical and water connections is afforded by two catwalks right along the top of the furnace.

Finally, the metal is broken out of the condensing boxes and melted down for refining purposes in high-frequency furnaces from which the metal is cast into ingots. A kW to 50 kW. They are all supplied at 1,050 cycles, 1,800 V, from M.G. sets which, number of these are of standard design and equipped with motor-operated tilting gear, and they vary in electrical loading from 400 with the necessary power-factor correction condensers and control gear, are installed in a separate room.

Development of Television

MR. ATTLEE announced in the House of Commons on Tuesday last that the Government had appointed a new Committee to consider and make recommendations as to the future of television after the war. The last reference to the original Committee was made in Parliament in February, 1940, when the Postmaster-General stated that after consultation with the Committee he saw no prospect of a television service during the war. The Committee shortly afterwards met representatives of the radio manufacturing industry " to discuss the probable lines of development of television in the more distant future."

The old Committee was left without a chairman, no appointment having been made to fill the vacancy caused by the death in 1941 of Lord Cadman. It is understood, however, that the new chairman will be Lord Hankey, and the Committee, which includes a number of new names, comprises Sir A. Stanley Angwin, Engineer-in-Chief of the General Post Office ; Mr. R. W. Foot, Director-General of the B.B.C. ; Sir Edward Appleton, of the Department of Scientific and Industrial Research ; Sir Noel Ashbridge, Deputy Director-General and Chief Engineering Adviser, B.B.C. ; Professor J. D. Cockroft, Air Defence Research and Development Establishment, Ministry of Supply ; Sir Raymond Birchall, Deputy Director-General of the Post Office ; Mr. R. J. P. Harvey, of the Treasury ; and Mr. J. Varley Roberts (secretary).

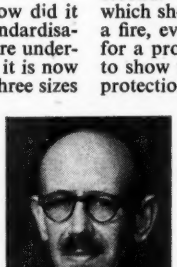
Socket Outlets

Adjuncts to the Domestic Ring Main

By Forbes Jackson, M.I.E.E.

IN the past few months there have been many discussions on the domestic socket outlet and several articles and letters on the subject have appeared in the *Electrical Review*. The opinions expressed have been so diverse that it would seem that an impartial survey might be of value.

First, what is the problem and how did it arise? The steps which led to the standardisation of the present three plug sizes are understood in the electrical industry, but it is now generally realised that in adopting three sizes insufficient consideration was given to the convenience of the consumer and particularly the domestic consumer. From his (or her) point of view it would be a great convenience if any portable appliance could be used from any socket and if there were an adequate number of sockets in all parts of the house.



Mr. Forbes Jackson is electrical engineer to the London County Council

Few portable appliances of 3-kW rating are supplied for any class of property and none at all for the smaller houses, so that a 2-kW outlet would satisfy all normal domestic requirements. Also, the increasing numbers of users of appliances will necessitate more outlets if tangles of flexibles are to be avoided. It would then be impracticable to continue with the one-outlet-per-circuit method and as Mr. E. Jacobi showed (*Electrical Review*, December 31st), the ring main is the best solution.

Protection of Points

A ring main of 7/·029 connected to one 30-A fuse would carry all the portable apparatus load in a small house even to the extent of sixteen or twenty outlets, the load being determined by the area served by the ring main rather than by the number of sockets. If the ring main is to be protected by a 30-A fuse, it is obviously necessary to have smaller fuses protecting the portable appliances and flexibles and it is suggested that this can be done by incorporating a 10-A fuse at each outlet either in the plug or the socket. The question arises as to whether a 10-A fuse (minimum fusing current 18 to 20 A) will give sufficient protection in all circumstances.

Several correspondents have expressed the view that in practice a domestic circuit fuse (15A) will always blow in the case of a flexible failure and that, in fact, all domestic fuses blow on short-circuit or earth conditions rather than on overload. This is the common experience and although in theory it would be possible to get a fault which led to a sustained overload just below the fusing current of the fuse, everyone knows that this does not happen and that such a fault would develop into a short-circuit in a fraction of a second. One correspondent has quoted tests which show that a 3-A flexible will not cause a fire, even when called upon to carry 20 A for a prolonged period. The evidence seems to show that a 10-A fuse would be sufficient protection in all circumstances, but perhaps further consideration should be given to the protection (or abolition) of the very fine flexibles sometimes associated with clocks.

It would seem that the 10-A plug will be used mainly in new domestic installations where all the plugs can then be of the same size. There would normally be no advantage in using it for additional points in existing installations where presumably the 2-, 5- and 15-A plugs would continue to be used. For cheapness and compactness the standard form would be an unswitched shuttered socket for AC only. It would also be three-pin.

We can therefore summarise the requirements as follows:—(1) To carry 10 A continuously with, preferably, some margin. (2) To provide 10-A single-pole fusing. (3) To have shuttered sockets. (4) To connect up easily to a 7/·029 ring main. (5) To provide all these in a safe, convenient and economical manner.

Broadly speaking, there are two proposals which require consideration, namely, the uprating of the existing 5-A plug to 10 A and the design of a completely new socket and plug to meet the new conditions. What are the advantages and disadvantages?

"Up-rating" Examined

Some at least of the existing 5-A plugs and sockets will carry 10 A and probably, with a tightening up of the B.S. Specification, all new ones could be made to do so. It is, however, equally true that many existing plugs and sockets will not carry even 5 A without overheating.

The principal argument of those who wish to uprate the existing 5-A three-pin plug is that it would avoid introducing another standard. As Mr. Jacobi has pointed out, however, this plug is a comparatively late comer and has to compete with the 5-A two-

pin in existing installations and the 2-A two-pin in new installations with the result that there are surprisingly few 5-A three-pin plugs in domestic premises. If, on technical or economic grounds, a change is desirable, now is the time to make it, and the desire to use a standard merely because it is a standard need not be given too much weight.

The question as to whether there is, in fact, any advantage in uprating the existing standard should be carefully examined. Presumably it would be an advantage to a user moving into one of the new houses if he happened to have some existing 5-A three-pin plugs that would fit the new 10-A sockets. So long as these were attached to small current-consuming devices they would be satisfactory, but probably they would lead to disappointment if used with 2-kW fires.

Possible Confusion

On the other hand, there is the corresponding disadvantage that a consumer moving from a new house wired with 10-A sockets to an old house wired for 5 A (or less) would find no advantage in interchangeability and might even find it a danger. This arises from the suggested future double rating of the plug, *viz.* 10 A in a new installation and 5 A in an existing one and this would lead to still greater confusion than that which exists at present.

A further point is that, since the majority of existing plugs are unfused, the uprating of the 5-A plug would entail putting the fuse in the socket and there is some doubt as to whether this is the best place for it.

On balance, it would appear that the dimensional interchangeability of the existing 5-A plug with the new 10-A ring-main plug might prove to be a disadvantage rather than an advantage. It would not benefit the user and it would be of little benefit to the manufacturer, since by the time he had modified the design to comply with a more stringent specification, incorporated a fuse in the socket and altered the plug head to take 10-A flexible, there would be little of his original product left except pin diameters and centres.

Fused Plugs or Sockets ?

If we find ourselves unfettered by any existing standard, what designs should we adopt to satisfy our five requirements ? As a first step, should the fuse be in the plug or in the socket ?

Critics of the fused plug have suggested that the blowing of a fuse at a moment of inserting the plug might injure the user. From this point of view it does not seem to matter much whether the fuse is in the plug or the socket since in both cases the user's hand would be in close proximity. In either case the important thing is that the fuse must be a good one. There is, of course, nothing novel in a fused plug, they have been in satisfactory use for a long time. Incidentally, the Wiring Regulations allow a fused plug but specifically forbid a fused socket.

If the socket is fused, a fuse carrier or the like, which will enable a fuse to be replaced safely into a live socket, must be provided. This will certainly increase the size and cost of the socket and, so far as can be seen, will make it impossible to fit it into a small circular B.S.S. box. The replacement of the fuse carrier might not be too easy if the socket were low on the wall. A further disadvantage is that the introduction of the fuse carrier involves extra contacts which have to carry the full current.

Several types of fused plug are available, including the fused-pin type described in the *Electrical Review* of October 29th by Major R. Amberton. Compared with the fused socket, the fused plug is simpler and considerably cheaper. It can be used with a normal socket which can in consequence be designed to fit into a standard small circular B.S.S. box, thus reducing tubing costs. If the fuse blows, the plug and its associated appliance can be removed to a suitable place (or even to the electrical shop) for renewal. The blown fuse is associated only with the appliance or flex which caused it to blow and the socket remains alive for other purposes.

An argument which has been advanced in favour of the fused socket is that it would prevent the socket being overloaded by a pyramid of adaptors. If the contacts have a reasonable margin—as they should have—this is not a very serious matter and in any case the whole purpose of the new design and technique is to provide a number of outlets which should render adaptors largely unnecessary.

Comparative Costs

Inquiries made lead to the conclusion that a fused socket would increase the cost of the combination by 2s. 6d. to 3s. 0d., whereas for a fused plug the increase would be about 6d. For a house having sixteen outlets the total extra cost of fused sockets as against fused plugs would amount to over £3 when all factors are taken into account.

Judging the matter unhampered by any existing standard, the best place for the fuse is in the plug. In discussions I have had with a number of engineers I find this view general, except among those who start with a bias in favour of uprating the 5-A plug, in which case a fused socket is the only solution.

The next question is the very vexed one of round or flat pins. I have seen good and bad figures of voltage drop for both types. The fact is that designs of round and flat contacts have gone through a number of changes and the conclusion I have reached is that equally satisfactory current-carrying designs of both types can be produced.

One of the most attractive possibilities of

the flat-pin plug is that referred to by Mr. T. C. Gilbert, *i.e.* that different sizes of plugs can be used in the same socket. Further examination, however, shows that this is not important. The physical size of a 2-A or a 10-A plug need not differ substantially. The question of discriminating fuses for different sizes of flexible does not arise, for it can be done equally well with a round-pin plug, if indeed it is necessary at all.

The fused-pin idea does, however, require a round-pin design. The whole question seems to boil down to this: Which design will result in the most compact, convenient, safest and cheapest fused plug? At present the fused pin would seem to offer the most promising line of development.

The criticisms made by Mr. Jacobi of the pin spacing of the 5-A three-pin plug are, I think justified. The legs of the isosceles triangle are, as he points out, too long. These dimensions were probably dictated by the desire to avoid accidental interchangeability with other plugs of substantially the same design. The plug as a whole is unnecessarily bulky. Assuming that the creepage distances in the case of the 2-A three-pin plug are sufficient with present-day plastics, then there is no reason why a 10-A plug should be substantially larger. It would be possible to put larger-diameter pins into a 2-A plug and get 10-A carrying capacity, non-interchangeability with any other socket, and small and convenient size.

Alternatively, there are obvious possibilities in arranging the contacts all in line. In this case the live contact could go in the middle and the earth and neutral at the sides. Polarity could be assured by the shape of the plastic portion of the plug which could fit into a recess in the socket.

No one can pretend that the present designs of plugs and the present circuiting methods are entirely satisfactory. We have an opportunity to put this right and to produce a really satisfactory domestic outlet system incorporating experience and materials not available when existing standards were made. The present consideration should be the interest of the consumer, and sectional interests, whatever their nature, inside the industry should be subordinated to this.

NEW BOOKS

Battery Electric Vehicles. By S. M. Hills, A.M.I.E.E. Pp. 206; figs. 135. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 12s. 6d.

This publication can be considered as the most concise report on electric vehicle development to date. It is particularly interesting to observe the reference made to the cutting down of battery capacity to a dangerous limit in the attempt to lower selling prices. It has become recognised that an electric vehicle must have an ample reserve of stored energy. A lighter-weight battery, essential to electric vehicle progress, will provide this. Mention might likewise have been made with regard to the reduced sizes of traction motors installed in some makes, the ratings of which were in certain instances so "under-nourished" as to cause much disappointment and servicing expense, through premature and normally unnecessary motor failures.

I read with pleasure the author's statement that the battery re-charging can now be regarded as an almost automatic process. There is little doubt that the future successful development of the electric vehicle depends largely upon a simple and rapid re-charging process. This, I contend, will ultimately be performed in a very different method from that which we know now.

I am also glad to see that the author makes the point that the average user of transport has little or no idea of what it costs him, and looks upon it as a necessary evil calculated to eat, most energetically, into the otherwise substantial profits. There is one certainty, however—that the electric road vehicle, when used for local delivery and when properly maintained, will eat far less into those profits than any other form of road transport.—H. G. W.

Engineers at Work. By H. E. Dance. Pp. 245; figs. 205. Thomas Nelson & Sons, Ltd., Parkside Works, Edinburgh. Price 10s. 6d.

In non-technical language and with the aid of numerous sketches and diagrams the author gives an account of many famous engineering achievements, including the Grid scheme, the Beauharnois power plant, the Mersey Tunnel and the Sydney Harbour and the Golden Gate Bridges.

The Blue Book: Electrical and Engineering Trades Directory. Ernest Benn, Ltd., Bouverie House, Fleet Street, London, E.C.4. Price 30s. net.

A heavy reduction in the content of paper is apparent in the 62nd (1944) edition of the "Blue Book" but the amount of useful information appearing is not materially changed. One important reform, begun in the 1943 edition, has been carried a stage further by the thorough revision of the headings in the Classified Section, from which, incidentally, the thumb index has been omitted.

Mechanical World Year Book. Emmott & Co. Ltd., *Mechanical World* office, 78, Palatine Road, Manchester, and 28, Bedford Street, London, W.C.2. Price 2s. 6d.

Revisions undertaken in the 1944 edition bring it into line with recent developments relating to new materials and their uses, as well as workshop and factory processes. Especially interesting and helpful are the chapters on light alloys, the selection and substitution of production processes, die-casting, plastics, steam boilers, arc welding, mechanical press work, gearing, and internal combustion engines. The sets of tables included are both comprehensive and well indexed.

Testing AC Motors

Trials under Full-Load Conditions

By K. Broom,
Graduate I.E.E.

AFTER AC motors have been rewound or repaired the tests carried out range from just coupling the motor to the mains and running it on no-load, to the more commendable practice of carrying out full-load runs of an hour or two's duration. Where rewinding and repairing are frequently done, the initial cost of rigging up a load-test plant is very often justified, for if a motor satisfactorily passes a full-load test in a contractor's own workshop, its re-installation, often costly, can be undertaken with confidence that it will perform its duty. Again, if a suitable set of instruments is available, any faults can be located or the power factor and efficiency of the motor calculated. The equipment necessary can often be found in the contractor's junk room—a good dynamo, slide rails, pulleys and old slates of resistance wire being the main requirements.

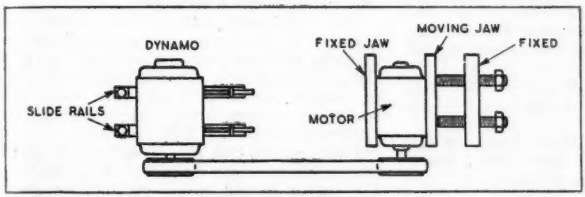


Fig. 1.—Arrangement of drive for full-load test

In the simplest form of load testing the motor belt-drives the dynamo, the output of which is dissipated in the slates of resistance wire. The dynamo is arranged on slide rails to permit pulley adjustments for different sizes of motor; the motor is clamped into a vice arrangement (not put on slide rails) that will permit of sideways adjustment. In this way motors of different sizes can very quickly be fixed, and the drive lined up with a minimum of trouble.

The instruments on the input side of the motor may consist of a voltmeter and ammeter with a short-circuiting switch to protect the instruments from damage due to heavy starting currents. The light-load amperes in each phase are ascertained by plugging the ammeter into a socket in each in turn; the short-circuiting switch is opened and the current in each line checked for balance. The dynamo is then belted to the motor and its load resistance or field rheostat adjusted until full-load current is circulating in each phase of the motor. After the speed has been checked the set is left on load for an hour or so. If the motor maintains a reasonable temperature rise after this run, it is a good sign, though not a sure one, that it is all right.

An inaccuracy of this method is that if the motor has developed a fault that reduces its efficiency, the circulation of full-load amperes may cause the motor, even though passing this test, to overheat when developing its full horse power after reinstallation.

In order to guard against this possibility a full-load test should be carried out with a wattmeter. The type of wattmeter is not important, but if a single-phase instrument is used in one line of a three-phase system the voltage must be taken between line and neutral and not between line and line, the total watts being those measured in one phase × 3. (It can be assumed that if the amperes are balanced in each phase, the watts will also be balanced.)

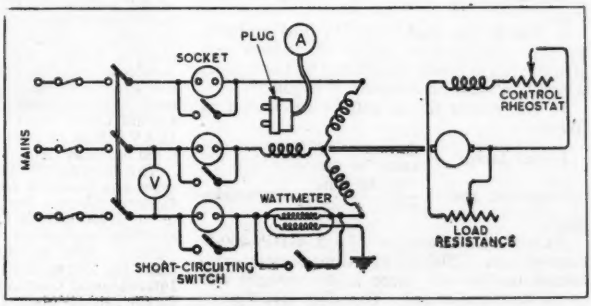


Fig. 2.—Wiring diagram of motor and dynamo

The procedure for slip-ring and cage motors is as follows:—

(*a*) Obtain the resistance of the windings, which, in the case of a star- or delta-connected motor arranged for direct-on-line starting, is the resistance across two of the line terminals × 1·5. If connected star-delta for use with star-delta starter (which must be in the "off" position), it is the resistance of one phase only.

(*b*) Run the motor without belt or pulley and measure the no-load watts, volts and amperes.

(*c*) Run the machine on load. Estimate the watts input required, which is $\frac{\text{horse power} \times 746}{\text{efficiency}}$, or merely circulate the estimated full-load amperes.

(*d*) Check readings of volts, amperes, watts and RPM whilst the motor is developing its assumed full load.

(*e*) From all the readings taken, calculate the horse power developed at the motor shaft. This is done as follows:—

1. From the no-load watts subtract the no-load copper loss. The latter = no load $A^2 \times r$, r being the resistance of windings. The difference gives iron loss, friction and windage loss.

2. Add to this the full-load copper loss, = iron, friction and windage loss + full-load $A^2 \times r$.

3. Subtract this from watts input on full load, *i.e.*, watts input − load stator losses, to obtain watts output from stator.

4. $\frac{\text{Watts output of stator}}{\text{Watts input of stator}}$ = stator efficiency. Rotor efficiency can be shown to depend on the ratio $\frac{\text{RPM at full load}}{\text{RPM synchronous}}$.

5. Efficiency of motor = $\frac{\text{Watts output of stator}}{\text{Watts input of stator}} \times \frac{\text{full-load RPM}}{\text{synchronous RPM}}$. For single-phase motors of the split-phase or capacitor-start type the efficiency = $\frac{\text{stator output}}{\text{stator input}} \times \left(\frac{\text{full-load RPM}}{\text{synchronous RPM}}\right)^2$, the resistance being that of the running winding only.

6. Divide the input by 746 and multiply by the calculated efficiency (5), which will give the horse power developed by the motor, which can then be adjusted if required.

7. The power factor can be calculated as follows:—

Power factor = $\frac{\text{watts input}}{\text{volts} \times \text{amps} \times \sqrt{3}}$ for three-phase, and = $\frac{\text{watts input}}{\text{volts} \times \text{amps}}$ for single-phase.

As a typical example take a 4-HP 400-V three-phase, 1,500-RPM motor, delta-connected inside with three leads brought out to the terminal board. Test data give figures for no load of 400 V, 3 A, 250 W at 1,500 RPM and for full load of 400 V, 6 A, 3,600 W at 1,450 RPM.

Resistance is 4Ω across two terminals. ∴ total resistance = 4 × 1·5 = 6Ω.

1. No-load W − no-load $A^2 \times r$ = $250 - 3^2 \times 6 = 196$.

2. Iron, friction and windage loss + full-load $A^2 = 196 - 6^2 \times 6 = 412$.

3. Watts input − load stator losses = 3,600 − 412 = 3,188 W.

4 and 5. $\frac{\text{Watts output}}{\text{Watts input}} \times \frac{\text{full-load RPM}}{\text{synchronous RPM}}$ = $\frac{3,188}{3,600} \times \frac{1,450}{1,500}$ = 85·5 per cent. efficiency.

6. $\frac{\text{Watts input}}{746} \times \text{efficiency} = \frac{3,600}{746} \times 85{\cdot}5$ = 4·1 BHP.

7. $\frac{\text{Watts input}}{\text{Volts} \times \text{full-load A} \times \sqrt{3}}$ = $\frac{3,600}{400 \times 6 \times \sqrt{3}}$ = ·875 power factor.

From test results similar to these it can readily and accurately be seen whether a motor is properly loaded and, if not, how much adjustment is required.

The procedure adopted by some contractors of measuring the output from the dynamo can be very misleading, as it is difficult to estimate the combined efficiency of motor, drive and dynamo with any accuracy; consequently the load on the motor cannot be correctly assessed.

Load testing can be carried out in about twenty minutes or even less with practice. The motor should be left on load for about 2½ hours, if continuously rated, and the temperature noted in order to see that it is within B.S.S. limits.

Australian Contracts

IT is reported in the *Electrical Engineer and Merchandiser* that the Sydney County Council has accepted the tender of the British General Electric Co. Pty., Ltd., for 17,985 yd. of Pirelli-General oil-filled 3-core 0·3 sq. in. 33-kV cable at a price of £92,062. This cable, it is stated, will be the first of its kind to be used in Australia.

The same authority has also accepted tenders of the British G.E.C. Pty. for 33-kV switchgear for Pyrmont power station (£3,496), 18,000 yd. of 0·007 sq. in. 3-core pilot cable (£4,468) and electric lamps for street lighting (£5,028). Tenders for 2,500 yd. 0·75 sq. in. and 500 yd. 0·4 sq. in. single-conductor 660-V cable have been accepted from Noyes Bros. (Sydney) and Enfield Cable Works (A'sia) Pty. (£3,656), and 11-kV 0·3 sq. in. submarine cable and pilot cable from Siemens (Aust.) Pty. (£3,587).

The New South Wales Public Works Department has placed a contract with the Australian General Electric Pty., Ltd., for the installation of a 7,500-kW B.T.H. turbo-alternator and auxiliary equipment at the Port Kembla power station. Also in connection with these extensions the Department has placed contracts with International Combustion Aust. Pty., Ltd., for steam raising plant (£59,201) and A. Reyrolle & Co., Ltd., for metalclad switchgear (£2,161).

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Grand Council of the Federation of British Industries has nominated **Sir George Nelson** for a second year of office as president. The nomination will come before the annual general meeting of the federation in April. Sir George is chairman and managing director of the English Electric Co., Ltd.

Sir **Clive Baillieu,** deputy-president of the Federation of British Industries, has accepted the chairmanship of the F.B.I. Empire Committee. **Sir Peter Bennett, M.P.,** a past-president of the Federation, will assist him as deputy chairman of the Committee. **Captain B. H. Peter** (managing director, Westinghouse Brake & Signal Co., Ltd.), the former chairman of the Committee, has been compelled to resign owing to his many other commitments. He will, however, remain a member of the Committee and of its executive.

We are glad to learn that **Mr. A. G. Everett,** chief mains engineer to the Hong Kong Electric Co. at North Point, is safe. He is now a prisoner of war in Sham Shui Po (Hong Kong "S" Camp).

Mr. Edgar Lunn, who, as announced last week, is retiring from the position of borough electrical engineer of Huddersfield, has been with the undertaking since 1900. He was trained at the Huddersfield Technical College and joined the Electricity Department as junior assistant, subsequently holding the positions of charge engineer, station superintendent, deputy borough electrical engineer and, in 1937, borough electrical engineer. His services are being retained for certain special work. Since 1928 Mr. Lunn has been hon. secretary of the Huddersfield Smoke Abatement Society, and, as member of the Yorkshire Fuel Efficiency Committee, has during the past eighteen months inspected some fifty factory steam plants in an advisory capacity

Mr. Edgar Lunn

Mr. F. A. Ellis

for the Ministry of Fuel and Power. He is a member of the Institution of Electrical Engineers and of the Institute of Fuel.

Mr. F. A. Ellis, who succeeds Mr. Lunn as borough electrical engineer was born at Bolton and is now forty-six. He was educated at Clifton College and the University College of Wales, Cardiff, which he left in 1914 to join the Army. He served in France and was gassed. On leaving the Army in 1919 he was apprenticed to C. A. Parsons & Co., Ltd., Newcastle-on-Tyne. In 1922 he went to Arthur Ellis & Partners, consulting engineers, of Cardiff, where he remained until 1936, when he joined the Yorkshire Electric Power Co. He became deputy borough electrical engineer at Huddersfield in 1939. Besides being an A.M.I.E.E. and a member of the Institute of Fuel, he is a member of the South Wales Institute of Engineers and the Illuminating Engineering Society.

The many electrical men who know **Mr. E. E. Hoadley** find it hard to regard him as a veteran of the industry, but it is a fact that his connection with the Institution of Electrical Engineers began exactly half a century ago when he was awarded a Salomans Scholarship. Since then he has been active in the counsels of the industry and is at present more busy than he ever was. He is chairman of the E.D.A. Council, president of the E.I.B.A., hon. secretary of the I.M.E.A., vice-chairman of the National Consultative Committee of the Central Electricity Board, and a member of the Fuel Economy Committee of the Ministry of Fuel and Power.

Mr. E. E. Hoadley

In addition to all these duties Mr. Hoadley recently became a kind of liaison officer between the electricity supply industry and the electrical manufacturers in connection with the electrical equipment of post-war homes. We should imagine that he has little spare time nowadays.

At Edinburgh last week members of the electrical trade in Scotland entertained to luncheon **Mr. H. C. Babb,** who has retired from the management of the Lothians Electric Power Co. and **Mr. J. Eccles,** city electrical engineer, Edinburgh, who is taking up a similar post at Liverpool. Mr. Babb, returning thanks, recalled that his interest in electricity supply dated from 1887. He traced the great developments which had taken place in the Lothians since the last war. Mr. Eccles commented on the growth of Edinburgh Electricity Supply Department during the past few years, and referred to the great help he had always received from the Electricity Committee and staff.

On January 5th a lunch was given at the Connaught Rooms to **Mr. T. F. Lee** by some of his friends in Standard Telephones & Cables, Ltd., to celebrate his completion of forty years' service with the company. During this period Mr. Lee has served in the Telephone Installation Department, the Telephone Engineering Department and the Sales Department, part of this time being as export sales manager. During recent years he has been secretary of various manufacturers' committees and a liaison official between the telephone manufacturers and the

General Post Office and other Government Departments.

Mr. T. G. Spencer, managing director of Standard Telephone & Cables, who was in the chair, gave the toast of the guest, and this was seconded by Mr. C. W. Eve, commercial director.

Mr. Garnet F. Pirson has been appointed chief engineer of the Midland Electric Corporation for Power Distribution, Ltd., as from January 1st. He has been deputy chief engineer for the past four years and succeeds **Mr. W. Weygood** who is to remain with the company in the capacity of advisory engineer.

Eastbourne Electricity Committee is considering an application from **Mr. N. Boydell,** borough electrical engineer, for an increase in salary. Although all the staff and employees under his control have received increases to compensate for the rise in cost of living, Mr. Boydell has received none. Moreover, since his appointment he has managed the undertaking without the deputy or chief assistant formerly considered necessary, and many additional responsibilities have fallen on him since 1940.

Mr. A. N. Aikman, who, as reported last week, has been appointed deputy city electrical engineer at Bradford, was born in Edinburgh in 1884 and was educated at Daniel Stewart's College, Glasgow Technical College and Glasgow University. From 1906 to 1910 he was engaged in the DC design department of Siemens Bros., Stafford, and then went to South Africa. For a few months he acted as assistant lecturer in electrotechnics at Transvaal University College, Johannesburg, and afterwards joined the distribution department of the Victoria Falls & Transvaal Power Co. Returning to England in 1920, he became switchgear engineer at the Willesden works of the B.T.H. Co. From 1928 to October last he was substations superintendent and electrical constructional engineer at Bradford. Mr. Aikman holds the B.Sc. degree of Glasgow University and is an associate of the Royal Technical College.

Mr. Charles L. Dalziel has been elected a director of Associated Electrical Industries, Ltd. He is chairman of a number of investment trusts, including the Investment Trust Cpn., Ltd., a sub-governor of the Royal Exchange Assurance, and a director of, among other companies, Barclays Bank (Dominion, Colonial and Overseas), and the Union-Castle Mail Steamship Co., Ltd.

Mr. J. N. Stephens, M.I.E.E., assistant to Sir Felix Pole, chairman of Associated Electrical Industries, Ltd., has joined the board of the Hotpoint Electric Appliance Co., Ltd. He is also a director of the Edison Swan Electric Co., Ltd., and the Electrical Manufacturers' Finance Co., Ltd.

Mr. Charles Dunbar, vice-chairman and managing director of the British Oxygen Co., was entertained to dinner last week by the directors to celebrate his completion of fifty years' service in the industry. Lieut.-Col. S. J. L. Hardie, chairman, on behalf of the company, presented him with a canteen of cutlery and other gifts from his colleagues.

Mr. J. H. Butler, M.I.Mech.E., A.M.I.E.E., chief engineer and consulting engineer of Barton & Sons, Ltd., Netherton, has resigned his position to join the Barrow Haematite Steel Co., Ltd., as chief engineer.

Mr. C. C. Penfold, sales manager, Bratt Colbran, Ltd., informs us that he has recently resigned his position, after an association of ten years with that company. He proposes to maintain his contacts with the industry in the post-war period.

Mr. W. S. Watts, director and designer of Bratt Colbran, Ltd., for the last sixteen years, has also resigned his position with the company.

Mr. Alan T. Godbold informs us that he is terminating his association with Woods of Colchester, Ltd., manufacturing electrical engineers, for whom has has been chief buyer for the past fourteen years. His present address is 49, Gladwin Road, Colchester, Essex.

Mr. Hugh F. King, of Manchester, has been appointed North West England sales representative to the General Cable Manufacturing Co., Ltd., Leatherhead.

Mr. Fitzroy Woods, M.I.E.E., general manager and chief engineer, of the Woking Electric Supply Co., Ltd., has been appointed to the board of directors. Mr. Woods has been chief engineer to the Woking Company since 1918, having previously served with Heston & Isleworth, the Lancashire Power Co., and Rawtenstall.

Obituary

Mr. E. Oxley.—We regret to learn that Mr. Ernest (" Bill ") Oxley, formerly sales manager of the New Insulation Co., Ltd., died at Stafford on January 3rd, at the age of forty, after a long illness. Mr. Oxley served his apprenticeship in Berlin with an associated company of the A.E.G. and received his technical education in that city, being later employed in the high-speed circuit-breaker department. He returned to England in 1922 and was employed in the drawing office of A. Reyrolle & Co., Ltd. In 1926 he joined the English Electric Co., Stafford, remaining there until 1936. He joined the New Insulation Co. as one of its first employees in 1937 as technical representative and sales engineer and was London sales manager until 1941.

Mr. J. T. Bowyer.—We regret to announce the death of Mr. John T. Bowyer, J.P., on January 14th. Mr. Bowyer had been with Callender's Cable & Construction Co., Ltd., for the past thirty-six years and had been manager of their Anchor Works, Leigh, Lancs., since 1908.

Sir Kynaston Studd, Bt., a former Lord Mayor of London, who died on January 14th, was active in the affairs of the Regent Street Polytechnic for the greater part of his long life—he was eighty-five. He succeeded Mr. Quintin Hogg as president in 1903 and continued in that office until his death.

Mr. J. O. Steiner.—The death is reported of Mr. Johann Otto Steiner, chief electrical engineer at the Britannia Works of Dorman, Long & Co. Mr. Steiner was of Swiss origin and had lived in this country for about forty years.

Mr. William Thomas Rawcliffe, a director of W. T. Rawcliffe & Son, Ltd., died on January 8th, at the age of sixty-three.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Boiler Availability

THE respective performances of boilers fitted with electrically-operated and manually-operated soot blowers would make an interesting comparison. Two steam generators of like design running under similar conditions and burning comparable fuels would afford the basis.

Soot blowing is an arduous and monotonous routine. The most vigilant operating engineer cannot hope to supervise personally the operation of each blower. Electrically-actuated soot blowers remove the hard work from soot blowing. If a boiler can be blown from a centralised push-button controller it is logical to assume that the job will be carried out better than if performed by the manual method.

Admittedly, efficient soot blowing is not the solution to all boiler availability problems. It is, however, a contribution that the operating staff can make towards the ultimate aim of improved performance. Electrification of soot blowers and other boiler auxiliaries is a policy that time will show to be remunerative to boiler plant administrators.

*Southgate, N.*14. G. T. SHEARS, Graduate I.E.E.

Nationalisation

THE letter from Mr. Walter Higgs, M.P., on the nationalisation of the electricity supply industry in your issue of January 7th, indicates that Mr. Higgs's practical knowledge of the electricity supply industry is very limited, however expert his knowledge of the manufacturing side of the industry may be.

As Mr. Higgs states that he has no intention whatever of re-examining the problem as suggested by you in your editorial comments or of altering his opinion in any way, it would obviously be pure waste of time for anyone like myself—with nearly forty years' experience in the supply industry—to expect Mr. Higgs to even consider any point of view differing from his own. I feel sure however, that the majority of your readers will approach this vitally important subject with an open mind and consider the views of one who is diametrically opposed to Mr. Higgs on this question of nationalisation or even regionalisation so far as the distribution side of the industry, as distinct from generation, is concerned.

As one who took an active part in the strenuous and effective opposition to the proposals of the McGowan Report in 1936-37, may I say that the views that we expressed at that time, to the effect that there was nothing radically wrong with the industry, have been fully vindicated under the stress of war conditions. I think it is true to say that no industry has met the unprecedented demands made upon it by the war with so little criticism as the electricity supply industry and this remark applies equally to both large and small undertakings.

At times when large additional supplies have been required for war industries, in practically every case that has come to my knowledge (and I have a good deal of information on this subject) they have been available before the factories were ready to receive them. Had the undertakings been nationally or regionally controlled, with the consequent red tape and attendant delays occasioned thereby, I suggest that the result would have been very different.

In my opinion, the primary object of any legislation should be to secure substantial and lasting benefits to the consumer and this object would certainly not be achieved by any form of nationalisation or regionalisation of distribution. Lord Portal (then Minister of Works and Planning) speaking in the House of Lords on June 17th, 1942, enumerated the various matters which, in the opinion of the Government, should receive consideration such as standardisation of voltages, uniformity in charges and conditions of supply throughout the country, etc., all of which I suggest can be adequately dealt with by evolutionary methods.

Nationalisation or regionalisation would take away all initiative from those employed in any particular area. In addition, it would very adversely affect the general body of consumers, and the small consumer in particular, who would have little or no opportunity of getting any disputes or grievances satisfactorily dealt with by Whitehall, except in accordance with some uniform set of rules and regulations.

The following, amongst other points, should also be borne in mind when dealing with this thorny problem:—

(1) Electricity supply, unlike the postal service for example, is a personal service and depends largely for its efficiency and success on the personal touch of the man on the spot, who knows the local conditions; and, as it is probably true to say that the demand of no two consumers is identically the same, it naturally follows that conditions which might be quite satisfactory for the general body of consumers in, say, Harrogate or Cheltenham would be quite unsuitable in, say, Wigan or Barnsley.

(2) Supply would be given under more or

less stereotyped rules and regulations, and the local manager would have no power to deal with disputes or complaints on their merits, but would merely have a book of rules which would have to be complied with in all cases and would, in point of fact, become largely a robot and filler-in of forms.

(3) It may be said that the postal service, which is nationalised, works quite satisfactorily, but to this statement I would reply that this service is impersonal; once a letter is posted, it is quite immaterial whether it was sent by Mr. Lovejoy or the Prime Minister.

It appears to me that most of our present-day difficulties and anomalies are primarily due to two main causes, *viz.*:—(*a*) variation in charges for bulk supply (the raw material of the supply industry) which should be given at the busbar of all authorised undertakings at a standard tariff if uniform charges to consumers are to be provided; (*b*) Acts of Parliament over sixty years old which are still in operation should, as advocated by Sir Herbert Williams, be brought up to date in one comprehensive Act.

In this connection, I would commend to Mr. Higgs himself the advice he gives to Sir Herbert, *viz.*: " that it is the duty of Members of Parliament to assist in bringing these old Acts into line with modern requirements." In doing so, he will, I suggest, render the greatest possible service to the industry.

Newcastle-under-Lyme.

A. J. C. DE RENZI,
Borough Electrical Engineer.

Dynamic Braking

IN his article in your issue of December 31st, Mr. T. Millar, in departing from fundamentals, has introduced inaccuracies, and as these occur early on, the subsequent calculations and results derived therefrom are in error. The equivalent circuit of Fig. 3 is indeed novel, representing an appreciable contraction of the usual circuit; no allowance appears to have been made for the rotor reactance. The author then obtains what is termed " the equivalent rotor resistance " from the parallel circuits of magnetising impedance and rotor resistance; the expression derived is in error inasmuch as the quotient should be raised to the half power.

The " equivalent rotor resistance " so obtained is, in fact, an impedance, and the author calculates the rotor loss on the basis of product of square of current and impedance, instead of product of square of current and resistance. The expressions for " equivalent rotor resistance " and torque, are now used as the basis for the remaining calculations.

The introduction of the symbol M appears to complicate matters unnecessarily. The text states that by substituting $M = \frac{X_M}{r_2}$ in the torque equation, the maximum torque value is obtained. The condition for the latter, using the author's torque equation, is when $r_2 = SX_M$. The two are equal when $S = \frac{1}{M}$.

The symbol S being the speed expressed as a fraction of the synchronous speed conveys definite information, but M, other than being the reciprocal of S, is meaningless. Why, then, does Mr. Millar first calculate M and then its reciprocal to find the speed, instead of obtaining it directly from $\frac{r_2}{X_M}$?

M is used also in the equation for average torque but $\frac{1}{S}$ would be equally convenient.

St. Albans.

A. D. J. RATCLIFFE,
M.Sc.(Eng.), A.M.I.E.E.

[Mr. Millar has seen a copy of Mr. Ratcliffe's letter and his reply is printed below.—*Editors, Electrical Review*].

MR. RATCLIFFE has overlooked the fact that in evaluating the equivalent impedance of the parallel circuits SX_M and r_2 we get $Z_p = r_2 \cdot \frac{(SX_M)^2}{r_2^2 + (SX_M)^2} + j\,SX_M \cdot \frac{(SX_M)^2}{r_2^2 + (SX_M)^2}$.

In deriving the equivalent resistance I have taken the real component of this expression; consequently his statement that I have used the equivalent impedance in working out the rotor loss falls to the ground.

Further, I do not see any fundamental inaccuracy in the expression for torque, which is obtained simply by converting the rotor loss to HP, and thence to torque by division by the speed, with the usual constant.

To introduce rotor reactance into the equivalent circuit would have defeated the object of the article by introducing a complication of the second order. Assuming, for instance, that the rotor reactance were of the same value as the resistance, the error would be about 10 per cent. at top speed, and of course much smaller over the range of speed considered. For that reason I have been content to allow for leakage in a simple manner by reducing the AC voltage by 10 per cent. in calculating X_M.

I am surprised that your correspondent has not commented on my neglect of the effect of saturation. In keeping X_M constant I assumed constant permeability of the magnetic circuit. The magnetising ampere-turns are the resultant of the stator DC excitation less the rotor reaction (vectorially). The latter varies with the speed, being zero at standstill. Hence we have a wide range of magnetisation, and it may be an over-simplification to keep X_M constant. By taking the normal excitation values in calculating X_M a normal degree of saturation is allowed for. The formula as stated tends to give lower values of torque than attained in practice,

but correction can be applied by choosing X_M in accordance with experience.

I cannot agree with your correspondent's comments on the use of the symbol M. The value of M is constant for a given braking condition, but S naturally varies from 1 to 0 over the speed range. My conception of M is that of a factor upon which the shape and average value of the braking torque-speed curve depends. There can be no objection to using the reciprocal instead, with a corresponding alteration to the formulæ.

T. MILLAR.

Domestic Ring Main

MR. JACOBI'S suggestion is admirable but, like Mr. A. J. Heelis, I am of the opinion that it is premature. This matter is very properly summed up by Mr. Heelis in his first paragraph, *i.e.*, "I suggest that it should first be ascertained whether it is not merely re-adjustments or improvements of existing and tried methods that are actually required."

There would be no point in re-introducing 10-A sockets and plugs, which indeed would only cause confusion, and to insist on 3-kW radiators being fixed would be a retrograde step. Another point that should not be overlooked is that a great number of people engaged in installation work have carried out work of a "shocking" nature and if such people were given the job of installing ring mains in houses, I am afraid the results would be disastrous.

Regarding the wiring to 15-A outlets, I believe in wiring these with 7/·029 cable and connecting each to a separate circuit on a distribution fuse-board. When 5-A outlets are required, these should be treated as lighting points and marked as such for the consumer's information.

Personally, my feelings are that it would be very nice if Mr. Jacobi's suggestion could be universally adopted, but I think that if he carefully examines the situation he will be obliged to agree with Mr. Heelis.

Glasgow. ALEX. MILNE.

Kitchen Planning

BRADFORD and Poplar have got their eyes on the domestic consumer, but have they thought much about the problem that they have in hand?

The refrigerator must always be in the coldest part of a kitchen; oven steam is bound to have the wrong effect in a composite unit. Those engineers who design a job like this need to spend a week with a refrigerator serviceman and they will revise their ideas and alter the layout before they commit themselves to the manufacture of these panel sets.

Make the cooker one unit and I'm with them, but keep the refrigerator by the window and put the working table and the ironing board in the same corner. Give the housewife daylight for ironing and pastry making and so that she can carry out properly the most essential duty to a refrigerator—cleaning the inside.

I would further suggest that the average working man has never more food in the house than would bait a mouse trap. Therefore, in blocks of six houses use one compressor and give each house a cupboard 2 ft. by 2 ft. by 2 ft., or 8 cu. ft., with a temperature of 40 deg. The public do not need ice cubes and do not want to make ice cream. They may want cold drinks but they should not be encouraged to drink water and beer below 55 deg. otherwise we shall have a nation of gastric patients.

Now look at the comparative capital cost and maintenance cost and let our engineers re-design their pets.

J. SCOTT
Chard. (Refrigeration Engineer).

Factory Installations

AT a meeting of the North Gloucestershire Engineering Society held in the Technical College, Cheltenham, on January 6th Mr. G. S. Nott, of Coventry, spoke on "Industrial Electrical Installations." The lecture, which had been given previously to the Coventry Electric Club (*Electrical Review*, September 24th, 1943) was illustrated by eighty lantern slides, some showing installations completed during the last two or three weeks.

A lively discussion followed in which one speaker advocated the installation of a large number of comparatively small transformers—say one for every third bay in a machine shop—in place of groups of 500-kVA transformers in substations. It was proposed to have them in the roof space at tie-bar level. While agreeing that substations should be placed at the gravitational centres of load, the author pointed out that the electrical installation in a machine shop should provide for a complete change of machine tools at short notice. He considered that one transformer covering a small area might become overloaded and its neighbour left permanently on light load. It was generally agreed that while the use of 5-ft. fluorescent tubes on a large scale must be regarded as "luxury lighting" in this country at the present time, this was undoubtedly the light of the future. Mr. Nott hoped that fluorescent tubes of various lengths and sizes and at greatly reduced prices would become available after the war.

Reorganisation of Supply

IT is stated in the January *I.M.E.A. Journal* that the I.M.E.A. Council has before it a joint report on the reorganisation of the electricity supply industry prepared by representatives of electricity supply associations. This is to be forwarded to members in the very near future and will be considered at an extraordinary general meeting. A supplemental report prepared on behalf of the I.M.E.A., dealing with the question of public ownership and control, and also generation, will be published at the same time.

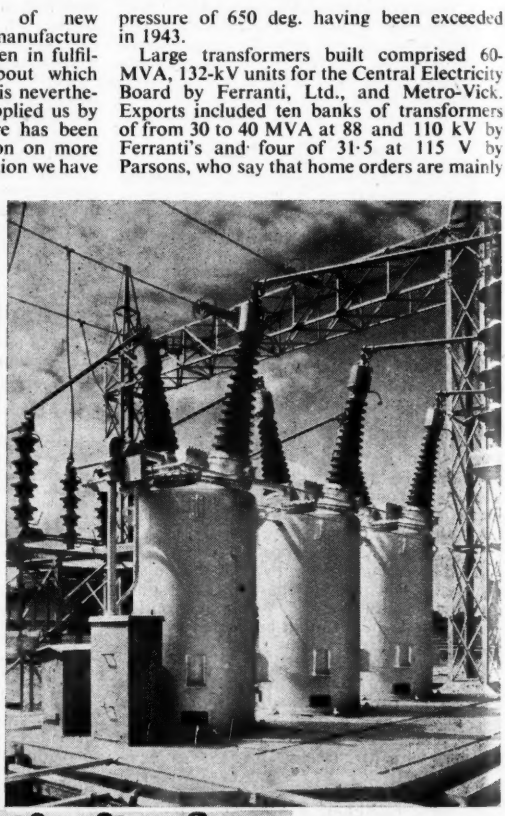
Manufacturing Progress

Limited Normal Development Proceeds

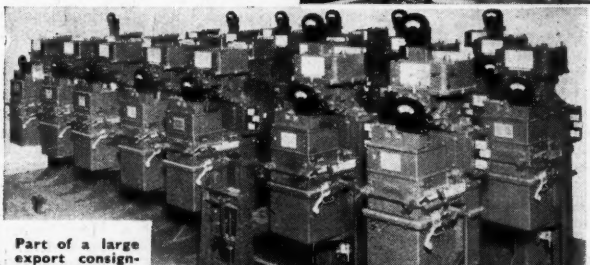
ALTHOUGH the majority of new developments in electrical manufacture during the past year have been in fulfilment of Government orders about which nothing may yet be published, it is nevertheless evident from information supplied us by many leading concerns that there has been considerable activity in production on more normal lines. From such information we have selected the few representative examples given below.

On the generation side the output of turbo-alternators has been well maintained. The construction of units of up to 50,000 kW has been undertaken by the Metropolitan-Vickers Electrical Co. and by C. A. Parsons & Co. (who also have received an order for a 40,000-kW unit for South Africa) and up to 30,000 kW by the British Thomson-Houston Co.—the alternator of one of the last-named being wound for 33 kV. Large extraction sets are in hand by Parsons (25,000 kW) and the B.T.H., and all three firms are executing orders for small self-contained units. Metro-Vick and B.T.H. also have in hand water-wheel alternators with ratings up to 33,000 kVA in the first case and 15,000 kVA (for India) in the second. Turbo-alternators, propulsion motors and auxiliary alternators are to be built by Parsons for three electric ships; steam conditions are 800 lb. per sq. in. and 850 deg. F. and inter-cylinder reheating to 850 deg. Otherwise we have no information of a pressure of 650 deg. having been exceeded in 1943.

Large transformers built comprised 60-MVA, 132-kV units for the Central Electricity Board by Ferranti, Ltd., and Metro-Vick. Exports included ten banks of transformers of from 30 to 40 MVA at 88 and 110 kV by Ferranti's and four of 31·5 at 115 V by Parsons, who say that home orders are mainly for power distribution, welding and furnaces and refer to a long list of reactors completed for both Great Britain and abroad. Full-scale tests with the stress-control system, involving one million volts in amplitude, have been carried out by Ferranti's, who also re-



Outdoor substation with 110-kV 1,000-MVA circuit breakers (B.T.H. Co.)



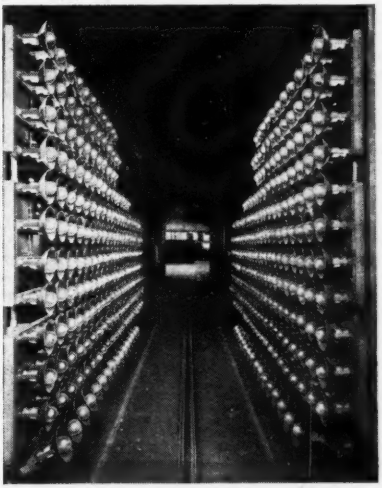
Part of a large export consignment of flameproof Reyrolle switchgear

port deliveries of surge absorbers to Natal for protecting the 1,200-HP 3,000-V motors of the main-line locomotives against lightning. For conversion to DC, the B.T.H. Co. has equipped a substation in London with 8,000 kW of pumpless mercury-arc rectifiers and has supplied to a railway in India a 3,000-kW 1,500-V unit of the same type.

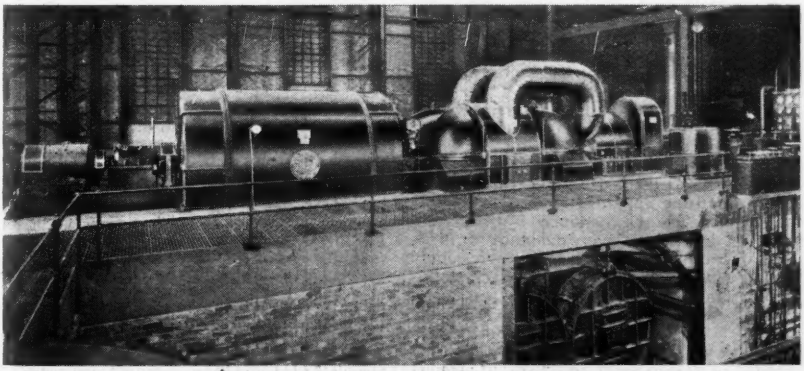
In addition to modifications in design to effect economies in raw material and simplifying manufacture, the B.T.H. Co. records the development of oil-less circuit-breakers for 6·6 to 33 kV (" Aeroblast ") and for 110 to 132 kV (" Aerojet ") with high rupturing capacities and speed of operation. Another development by the same concern is 100-MVA 3·3-kV switchgear with high-speed contact operation. A large number of orders has been completed for oil circuit-breakers which embody new features, such as the fitting of a 3,000-A 6·6-kV breaker to a standard 350-MVA metal-enclosed compound-filled gear and the introduction of a single-break unit with self-compensated explosion chamber for ratings up to 250-MVA at 6·6 and 11 kV. The Metro-Vick switchgear department has been occupied mainly by extensions to existing installations and by urgent reconditioning measures abroad.

Orders for both metal-clad and open-type circuit-breakers with single or duplex air-blast turbulators are being met by A. Reyrolle & Co., who report a substantial demand for high-speed pneumatically-operated outdoor small-oil-volume units for the British Isles and overseas. In the mining range a new 5-MVA 200-A switch is believed to be the first to receive an " Asta " certificate for a flameproof air-break panel. The introduction of special control and protection for arc furnaces has enabled standard switchgear to be used with a minimum of maintenance. Large overseas orders for protective gear have also been met.

Among the numerous large salient-pole motors constructed was a 20,000-kVA synchronous condenser by Metro-Vick and another of 15,000 kVA (for New Zealand) by the B.T.H. Co., which also completed several 4,000-HP synchronous-induction motor-generator sets for electrolytic work and has under way 50- to 25-cycle frequency changers for India of up to 10,000-kW capacity. A B.T.H. electric winder just commissioned in Scotland, capable of meeting peak loads of 3,900 HP, is believed to be the largest AC set in Great Britain and the first to operate here at 6·6 kV. Heavy peaks of 6,000 HP are also required to be dealt with by two light alloy reversing mills



Bank of infra-red industrial heating lamps (Metro-Vick)



Parsons 30,000-kW turbo-alternator for 11-kV generation with condensing plant in a British power station

with Ward-Leonard control, which have been electrically equipped by the same works.

Orders for induction motors up to 6,500 HP and associated control gear for a similar range of heavy duties have been received by the Metro-Vick Co. as well as for large numbers of smaller motors, a substantial proportion of which is required for collieries and also for dispatch to Russia. Mining equipment in hand includes AC winders up to 750 HP for both conversions and new installations. Special flameproof equipment has been developed for use with United States coal-face machinery. An equally vigorous demand is reported by them for DC motors for boiler-house auxiliaries, hoists and machine tools in addition to those required in tube mills with Ward-Leonard equipment. Ten locomotives ordered from Metro-Vick by the South African railways are nearing completion and a large number of trolley-bus equipments have been supplied for the Ministry of War Transport.

Welding Plant

While the heavy demand for DC welding equipment for one or many operatives has continued, Reyrolle's have found it necessary to increase their range of arc-welders to include multi-operator AC transformer sets, partly in order to obviate the manufacture of generators. An extension of automatic arc welding for special programmes, in addition to AC and DC manually operated units, is reported by Metropolitan-Vickers who also mention the valuable part being played by atomic hydrogen welding in tool repairs, and state that spot welders of up to 650 kVA are being supplied for high-speed work on light alloys and combined spot-projecting welders of both 2,500 and 8,000 lb. loading.

There has been a demand, Ferranti's state, for voltage regulators of all kinds. The Astatic temperature controller has been found effective in several installations for maintaining 1,500 deg. C. within 5 per cent. and the Astatic relay has been applied to the control of industrial processes requiring constant current rather than the original constant voltage for which, however, fresh scope has been indicated in many ways. Recent developments of the company include electric dynamic balancing machines and electronic magnetising equipment, embodying an Ignitron, for the control of spot-welding, X-ray and magnetising apparatus.

Difficulty is being experienced by the Metro-Vick Co. in meeting heavy demands for high-vacuum equipment which is being increasingly used for production, as in X-ray crystallography and metal-film deposition on glass, as well as for research work. There is notable activity in infra-red heating equipment and expectations of saving 90 per cent. of the time entailed in drying paint and putty in aircraft factories are said to have been substantiated.

Fuel Economy

AN address on the endeavours of the Fuel Engineering Department of the Ministry of Fuel and Power to assist consumers to burn, with minimum loss, all fuels they may be directed to use, irrespective of their types and grades, has been delivered by Mr. R. Clayton (one of the Ministry's engineers) to the Institution of Engineers-in-Charge.

His remarks referred mainly to internally fired boilers of the narrow-flue variety, and consisted largely of hints on ways and means of minimising the various losses commonly experienced.

Until recently the Ministry's fuel efficiency drive has been concentrated on improving the standard of maintenance and operation of existing plant, but the coal situation now demands that those efforts should be reinforced by the freer installation of equipment which will save fuel without restricting the variety or size of coals that can be burned, or which will reduce selectivity. Licensing procedure has been considerably simplified so that if the estimated economy in coal that may be secured within two and a half years from the date the scheme is sanctioned (assuming industrial coal to cost £2 per ton) exceeds the capital cost of the equipment to be added, then, generally, appliances within the aforementioned categories will be authorised by the department.

In dealing briefly with some of the appliances for which applications are most frequently sought, Mr. Clayton mentioned that the Department had contributed financially to experiments which had been carried out to ascertain just what various machine stokers would do with different coals, finally commending to his audience some 27 fuel efficiency bulletins published by the Ministry.

Building Apprenticeship

THE first report of the Building Apprenticeship and Training Council, set up "to observe and advise on all matters concerning the recruitment, education and training of young persons for craftsmanship and management in the building industry, and to encourage the development of apprenticeship schemes on a comprehensive basis" has now been published by the Ministry of Works (H.M. Stationery Office, price 6d.). Electricians and heating, ventilating and domestic engineers are among the craftsmen for the training of whom the Council considers it will be primarily concerned.

The Council has come to the conclusion that in view of the probable requirements of the building industry for apprentices the industry will be able, for some years after the war, to absorb all the apprentices that may be forthcoming in each of the crafts, whether they have received junior pre-employment education for building or not, without in any way prejudicing the prospects of employment for all apprentices who enter or for existing craftsmen. The probable nature of post-war work emphasises the necessity for a boy to receive junior pre-employment education for building before entering apprenticeship, and it is recommended that all apprentices should be required to attend a technical course of instruction up to an age of at least 18 years.

COMMERCE and INDUSTRY

Jobs for Ex-Service Men. Efficient Steam Use.

Reinstatement of Employees

LAST week the text was published of the Reinstatement in Civil Employment Bill which was introduced into Parliament before the Christmas recess. This is a detailed measure extending the provisions for reinstatement of Service men upon their return to civil life contained in the National Service Acts and Defence Regulation No. 60DAA.

The extension covers volunteers in the armed forces, the women's auxiliary services and men and women called up for whole-time service in the Civil Defence forces. The procedure for reinstatement is laid down and committees for determining disputes are provided for.

Broadly, employers will have to take back former employees for a period of at least 26 weeks, or for so much of that period as is "reasonable or practicable" (an attempt is made to define this phrase) or to pay compensation in lieu of this.

American Conspiracy Trial

The Pawtucket plant of the Anaconda Wire & Cable Co. and four officials of the plant were found guilty last week by a Federal jury on a charge of conspiring to manufacture and deliver defective wire to the U.S. Army Signal Corps between November, 1940, and September, 1942. The maximum penalty for the charge of which the men have been found guilty is a fine of $10,000 and two years' imprisonment. The sentence was to be pronounced this week. The Judge refused to allow the defendants bail and ordered a sixth defendant, an employee at the Pawtucket plant, who had earlier changed his plea of "not guilty" to one of "guilty," to be brought before him for sentence at the same time. (*Reuter.*)

Industrial Research

Among the recommendations made in the F.B.I. Report on Industry and Research was one suggesting the establishment of an organisation whose principal objects would be to stress continuously the need for industrial research and to promote and foster it in all possible ways. The form and functions of this suggested organisation were discussed at a recent conference summoned by the Federation of British Industries and attended by representatives of the Royal Society, the Department of Scientific and Industrial Research, the universities, and the research associations. A full discussion took place and a sub-committee was appointed to inquire further into the subject and to report back to a further conference.

Machine Mining

The *Production & Engineering Bulletin* for January states that at a special training centre established in the Sheffield district the Ministry of Labour and National Service, in conjunction with the Ministry of Fuel and Power, has organised training for experienced mining personnel in the operation and maintenance of machinery of the kind used in American mechanical mining methods. The course lasts four weeks and is designed to enable the men, upon their return to the collieries, to supervise and train other men in the operations in which they have been instructed.

It is hoped also to develop at this centre the training of fitter-electricians for the mining industry.

Projector Lamp Restrictions

The Ministry of Aircraft Production states that, in view of the shortage of projector lamps—that is, lamps with concentrated filaments for use with optical projection apparatus or floodlight reflectors—it has been found necessary to impose a restriction on their sales. All would-be purchasers of projector lamps are now required to state with their order the purpose for which the lamps are required.

Steam Peaks

Notes on the detrimental effects of peak-load steam demands on heat consumption per unit of factory output are given in Fuel Efficiency Bulletin No. 26, issued by the Ministry of Fuel and Power. Methods of smoothing the steam curves are suggested, *e.g.* by the staggering of processes or the use of spare Lancashire boilers (diagrammatically illustrated) as steam accumulators. It is suggested that established practice may often prove to be the most serious obstacle to improvements. A number of steam-demand diagrams for various trades and heat-disposal curves are included in the nineteen pages of the Bulletin.

Trade with Spain

A Valencia firm importing electrical equipment wishes to get in touch with British manufacturers who may wish to export their products to Spain after the war. The firm deals in wireless sets and accessories, irons, fires, instruments, plastics, in fact light and medium electrical equipment of all sorts. We shall be pleased to forward particulars and catalogues from interested manufacturers.

Fan Control

Four patented devices are available for controlling the volume of air, or boiler flue gases, delivered by constant speed fans when operating at loads below the maximum outputs which they and their AC driving motors are capable of furnishing in emergencies. They are fully described in a technical publication (SF.355) with illustrations and performance charts issued by Davidson & Co., Ltd., Sirocco Works, Belfast, Northern Ireland.

There are differential and drum types for side-flow inlets as well as an axial flow design developed specifically for power station boiler plant in continuous service over lengthy periods, while for smaller installations the "Semicire" type involves less outlay. All these regulators utilise the now well-known principle of creating a swirling flow on the suction side of the fan, so tending to reduce the aggregate of driving power

absorbed, in contrast to the simpler use of ordinary dampers that wastefully dissipate pressure (surplus to immediate requirements) developed by the fan.

Inlet control so guides the entering air as to induce it to swirl in the direction of rotation of the fan wheel, thus giving the incoming air a tangential component of velocity as it enters the rotor, which can be adjusted so that any desired output within the fan's useful range can be conveniently selected more effectively than with ordinary damper regulation, though not so efficiently as by varying the fan speed.

Spot-weld Testing

Two shear-test pieces for materials more and less than 18 SWG thick (0·048 in.) are described in BS.1138 with the object of standardising production control procedure so as to provide reliable indication of the quality of spot welds in aluminium alloys. It contains clauses dealing with both the welding and testing procedures as well as the various test results that should be recorded. Copies are obtainable for 1s. each from the British Standards Institution, 28, Victoria Street, London, S.W.1.

Temperature Gauging

For sound welded construction it is advisable to preheat accurately high-tensile steels, non-ferrous metals and cast iron. For gauging preheat temperature, which has not hitherto been easy under workshop conditions, "Tempilstiks" are convenient and accurate within plus or minus 1 per cent.; they are chemical mixtures rather like crayon pencils, each with a fixed melting point, and are now available in sixteen grades for from 125 to 700 deg. F.

A mark about 0·5 in. long is made on the job to be welded in much the same way as a chalk mark would be made. As heat is applied the mark begins to melt, virtually disappearing when the temperature marked on the particular "Tempilstik" being used has been reached. When the entire surface of the work comes into contact with the preheating flame the procedure is periodically to remove the flame and mark the job as before; in this case the correct temperature has been reached when the mark melts as soon as it is made. Charts of the ranges of preheat temperatures recommended for different metals are obtainable from the Director of Sundry Materials, Ministry of Supply, 8, Old Jewry, London, E.C.2.

Australian Import Restrictions

According to the *Board of Trade Journal*, the Australian Government has placed further restrictions on imports from sterling areas as from January 1st, 1944. The following goods have now been brought under administrative control (*i.e.* although not admissible except under licence, quota restrictions do not apply; applications for licences are dealt with individually on their merits):—

Milking machines; dairy coolers; elements imported separately; electric heating and cooking appliances, n.e.i.; lighting arrestors suitable for use for the protection of the principal electrical plant of a power station or substation; current limiting reactors; automatic voltage regulators; induction voltage regulators including the operating and control gear; liquid slip regulators; electrically operated thrusters and time switches except those controlled by electric master clocks; controls of the Scherbius, Kramar, Ward-Leonard or other similar types for motors above 300 HP; fuses for voltages less than 1,000 and having a rupturing capacity in excess of 5,000 kVA; dynamo-electric machines exceeding 150 HP; static transformers, n.e.i.; condensers, n.e.i.; arc lamps, n.e.i.; electric vacuum tubes, n.e.i.; cathodes ray oscilloscopes, oscillographs, measuring and recording instruments, n.e.i. (excluding vacuum tubes for use in appliances designed for the alleviation of deafness).

Workmen's Compensation

In the article on the Workmen's Compensation (Temporary Increases) Act in our issue of December 24th, it was stated that children's allowances rose from 5s. to 10s. a week after thirteen weeks. Actually this increase applies only to the allowance in respect of a wife. Also it should be made clear that the Act says that the allowance shall be payable in respect of a wife who is married to the employee at the time of the accident.

Runbaken Fire

Runbaken Electrical Products, Manchester, inform us that a fire which recently occurred in the winding department of their works did not seriously affect general production and that everything is now running normally.

Micro Lathes

We are asked by Pultra, Ltd., Salford, to state that the company's micro lathes and equipment are manufactured in Manchester. They are not, as has been suggested, imported from Switzerland.

Electrical Company's Coming-of-Age

On February 14th, the Autocar Electrical Equipment Co., Ltd., will celebrate the twenty-first anniversary of its foundation.

Changes of Address

Premises have been taken over by Standard Telephones & Cables, Ltd., at Cambrian Chambers, 51, Broad Street, Bristol, 1 (telephone, Bristol 20613/4 ; telegrams, Microphone, Bristol). Mr. W. F. Litherland, Western Area manager, is in charge.

The Purchasing Officers' Association has moved its offices to Walter House, Bedford Street, Strand, London, W.C.2.

TRADE MARK APPLICATIONS

THE following applications have been made for British trade marks. Objections may be entered within a month from January 12th:—

BENJAMIN. No. B622,473, Class 11. Lighting installations, lighting fittings and parts (not included in other classes) of all the said goods.—Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17.

LAMINEX. No. 625,449, Class 17. Electric insulating material and insulating sleeving made therefrom.—United Ebonite & Lorival, Ltd., Springside Works, Little Lever, nr. Bolton.

Substation Auxiliaries

Need for a Comprehensive Plan

By J. H. M. Sykes

MANY substations in which primary plant of the highest quality has been installed with great care suffer from the haphazard manner in which accessory apparatus has been added from time to time. The following suggestions are made with a view to avoiding the congested and inaccessible layouts which result.

It is essential that the design should be considered as a whole. All standards of wiring, for instance, must be co-ordinated. Ample space must be left for installing not only the obviously needed multi-core cables for the main control panels but also the lighting, heating, telephone, clock, impulse control and other auxiliary wiring, as well as any air, water, oil and fire-fighting pipework that may be required now or later, and there must be adequate room for the workmen to operate during installation. Taking one example of faulty design : lighting is often arranged so that tall panels cast deep shadows.

Battery Arrangements

Batteries must always be in a separate compartment, the greatest possible space being left for maintenance and inspection. It is a great advantage to be able to get at both sides of a bank of glass cells. A sink, with a draining board, should also be provided : the floor should be sloped, with suitable draining arrangements. The general design should preclude the possibility of lead-acid and alkaline cells being used in the same substation, although this is sometimes seen. Where low voltage is exceeded, the Electricity Regulations lay down minimum clearances and if low- and medium-voltage batteries are in the same substation, great care is needed to ensure that these clearances are maintained.

Compressors for air-operated gear should be well away from the relay room or other control point where telephoning is necessary or where attendance is continuous, as the noise and vibration can be distressing. Compressors and air-receivers should be housed in a separate room with adequate space for maintenance and for removing the air-receiver bodily if required. The periodic inspection of the high-pressure vessels called for by the Factory Acts must be catered for by allowing sufficient room for men to manœuvre themselves inside. Convenient plugs for portable lamps should be available.

Where air-drying facilities are provided, water drains from the filters and de-hydrators should run to the outside of the building. Pipework layouts should not foul floor spaces. A clear diagram of the pipework layout should be displayed in the compressor room.

Impulse control gear often consists of a motor-generator with associated relay panels and busbar transformers. Motor-generators, which emit some noise, should be housed away from the control and relay room ; this has the further advantage that workmen engaged on maintenance need not move heavy and dirty rotors in the vicinity of relay panels. The AC and DC supplied to this gear should be drawn from properly co-ordinated sub-distribution boards to enable maintenance to be safely carried out. The finish and general design of the panels, as regards, for instance, dust-proofing and vermin prevention, should line up with the other gear in the substation.

Telephones should be centrally situated for use in quiet at a table, from which the user can see instrument indications and relay panels at the same time. Telephone wiring should be in ducts in the floor and separated from all other wiring. Convenient terminal blocks with easily-removable links are required at centralised points so that where telephone wiring enters, for instance, multi-core cables, testing and regrouping may easily be carried out.

Auxiliary Supplies

Auxiliary supplies, usually 400-230 V, should be in duplicate, with automatic change-over contactors. The supply so selected should be led to a metalclad distribution frame whence run clearly labelled and grouped separate supplies to every item of plant, with liberal provision for spare circuits. Connections of batteries and their trickle chargers, which should always include a " boost-charge " feature, should be brought in to a common DC switchboard, with provision for a tapping point on each battery to facilitate low-voltage operation tests on switchgear and relays.

The use of cable basements below ground level should be avoided, as it has been found very difficult to ensure that water does not enter either through cable ducts or concrete foundations. An alternative is to raise the height of the building by the necessary amount, about 6ft. 6in., or to terminate the cables in a separate room alongside the switchgear but on the same level.

In addition to the general lighting, which should be designed to avoid glare (a common fault) and heavy shadow, there should be

emergency lights, battery-fed, which afford a reasonable standard of general illumination in every room. Sufficient plugs for handlamps should be provided, especially in rooms where mechanical details are overhauled. As a final resort, rechargeable battery handlamps, having a proper receptacle and charging arrangements, possibly tapped from the main trickle-charger, should be provided at obvious points, such as immediately inside doors and access passages.

Alarm System

Alarms of every kind should be centralised on an annunciator panel giving a luminous indication as to the particular feature in trouble and at the same time sounding a soft but penetrating buzz. This buzz should be repeated in any part of the building where it cannot readily be heard from the control room. Manufacturers of specialised gear, such as fire-fighting systems and supervisory-control apparatus, should be informed of the general alarm scheme and given numbered cores leading to the annunciator panel with full information as to the voltage, polarity, etc., of the alarm supply, in order that their alarms may conform to the existing arrangements. When parts of the fire-fighting gear are out of commission, red lamps should light up at points adjacent to the chambers affected.

When the buzzer is cancelled, a flashing light should be left in operation as a constant reminder. Links should be provided to isolate for test purposes any particular feature. If the alarm scheme is extended to a remote control point, the alarm, without the local buzzer, should always be shown on the annunciator panel, and if the whole of the alarms at any particular time are intended for reception at the remote point, a luminous indicator should convey this information to any persons engaged in work.

Storage accommodation should be provided for spare bushings, contacts, gaskets and the like, with a simple system of stock cards requiring the minimum of clerical work for the maintenance staff. The engineer responsible for ordering replacement spares should be immediately notified when a part has been used. Every single item should be so labelled as to point unmistakably to the gear to which it applies. Bakelised-paper insulation should be stored in a warm and dry atmosphere

Special tools should be hung on "shadow"-type boards, where the absence of a particular tool is easily noticed. Earthing equipment also should be kept on wall-mounted shadow boards so that all items are seen to be present and a quick inspection of the braids and cables is facilitated. Danger notices and barriers should be mounted near by, to assist the maintenance staff when preparing to work on an item of primary plant. A lifting beam incorporated in the building of the storage space is of great assistance, and if it can be used to bring indoors items of outdoor substation plant for maintenance under adverse weather conditions, it will quickly repay its cost by avoiding waste of time.

A complete and up-to-date set of drawings should be provided in a convenient plan cabinet, subdivided for easy and quick reference. A great boon is an adjacent flat surface—possibly in the form of a collapsible table or shelf—on which the prints can be laid out and studied.

Even in normally unattended substations, it is wise to incorporate such facilities for the staff as a lavatory and wash-basin with water heater, a bench for meals, with a small cooker and convenient racks for clothes. Substation maintenance is often carried out for long hours at short notice in places where ordinary outside facilities are not available.

Heating should always be based on the possibility of men having to work for long periods in any part of the building. This avoids the danger of domestic-type radiant fires being used in confined spaces, sometimes causing 3-kW loads to be found on tubular-heater circuits designed for 750 W. To avoid waste in unattended substations, a portion of the tubular or convection-type heaters can be left in circuit on thermostatic control, the remainder being switched on as desired.

A uniform tally, of metal, should be used for every key in the station, even if it relates to non-electrical apparatus. Two glass-fronted cabinets should be provided, one to contain the "electrical" keys and the other for the remainder. The former may with advantage be laid out in the form of a mimic diagram of the station; this procedure will simplify the locating of a particular set of keys.

Adequate Labelling

Expenditure on clear and adequate labelling is always well repaid. Reliance should never be placed on reference to a diagram to ascertain, for example, the function of a particular relay. Every relay or link or switch should have its function shown on a closely-adjacent label. Busbar protective schemes especially, in which one relay may trip a whole section of busbar, should be clearly labelled, not only as to the relay operation but also as to the means provided for isolating the tripping from each switch and section. The functions of special tools and setting jigs should be engraved upon them, and manufacturers should be requested to mount their data plates on items of plant where they can be seen from the ground, read (if possible) without making the apparatus dead, and unlikely to be obscured by paint.

Peru's Import Trade

Increased Participation of South American Countries

ACCORDING to the foreign trade returns recently issued by the Government of Peru, imports of electrical goods into that country in 1942 were about 13 per cent. less in value than in 1941. About seven-tenths were accounted for by the United States and the share of Great Britain remained very small—less than that of Switzerland and Sweden. A feature of the trade was the progress made by Argentina, which had about one-eighth of the total to its credit, with a 50 per cent. increase on 1941. Brazil's participation made a spectacular advance, while Canada's was just maintained. The accompanying table shows the values of the principal items in 1942, with a note of increases or decreases. (£1=20 soles.)

The United States has been the principal supplier of Peru's imports generally during the war, although in spite of handicaps Great Britain has also maintained an important volume of trade in certain lines other than electrical. Peruvian manufacturing industries have been operating to full capacity and with satisfactory profits.

According to the Lima branch of the Bank of London and South America the first four years of the war did not affect Peru's economy to the extent which had been anticipated. Over the whole period the value of exports exceeded that of imports, but the favourable trade balance has not been sufficient to result in a heavy surplus of foreign exchange.

Class	1942	Inc. or dec.
	(Thousand Soles)	
Switches, circuit-breakers, etc.	1,009	+ 35
From Argentina	348	+ 321
„ United States	588	− 189
„ Great Britain	18	+ 2
„ Canada	15	+ 7
Batteries up to 30 kg. and parts	552	− 198
From Canada	73	+ 39
„ United States	467	− 215
„ Great Britain	8	− 23
Batteries over 30 kg. and parts	43*	− 35
Insulators	305	+ 121
From United States	265	+ 140
„ Great Britain	21	+ 17
„ Canada	1	− 27
Insulated wire and cable up to 3 mm.	821	+ 362
From United States	377	− 1
„ Great Britain	3	—
„ Brazil	201	+ 186
„ Canada	17	− 43
Covered copper wire over 3 mm. diam.	783	+ 462
From Brazil	498	+ 498
„ Canada	50	+ 41
„ United States	233	− 79
Wire and cable up to 3 mm. lead-covered	33	− 2
From United States	5	− 11
„ Great Britain	3	− 8
„ Canada	24	+ 22
Flex, covered with fabric	67	+ 27
From United States	17	− 2
„ Brazil	44	+ 42
Copper wire over 3 mm. diam. lead-covered	27	− 9
From United States	9	− 19
„ Canada	19	+ 19
Wire, insulated or uninsulated, lead-covered or armoured	71	− 176
From United States	66	− 40
„ Canada	1	− 19
„ Argentina	4	+ 4
Telephone cable, lead-covered	217	+ 127
From United States	202	+ 194
„ Canada	15	− 43
Telephone apparatus	304	+ 93
From Argentina	77	+ 59
„ United States	97	+ 28
„ Sweden	95	+ 36
„ Great Britain	29	+ 27
Radio apparatus	2,553	− 398
From Argentina	312	− 281
„ Great Britain	12	+ 6
„ United States	2,223	− 37
Electro-medical apparatus	310	− 126
From United States	293	− 119
„ Brazil	3	− 16
Heating apparatus over 10 kg. including industrial	191	− 189
From United States	131	− 196
„ Switzerland	15	− 32
„ Canada	37	+ 34
Household heating and cooking apparatus, not over 10 kg.	77	− 22
From United States	51	− 36
„ Switzerland	7	− 3
Ammeters, galvanometers, etc.	76	− 121
From United States	58	− 121
„ Switzerland	15	+ 2
Switchboards	330	+ 170
From United States	130	+ 6
„ Canada	58	+ 53
„ Sweden	65	+ 65
„ Switzerland	62	+ 43
Lamps up to 50 W	379	− 247
From Brazil	—	− 90
„ United States	274	− 99
„ Argentina	70	+ 70
„ Sweden	29	+ 21
Lamps, 50 to 200 W	252	− 82
From United States	155	− 92
„ Sweden	49	+ 48
„ Argentina	43	− 18
Lamps over 200 W	125	− 2
From Argentina	15	—
„ United States	85	− 16
„ Sweden	18	+ 12
House meters	206	− 138
From Switzerland	63	− 74
„ Canada	138	− 53
Current transformers over 1 kW and rectifiers over 3 A	452	− 315
From United States	243	− 305
„ Switzerland	198	+ 8
Radio valves	192	− 25
From Great Britain	23	+ 8
„ United States	148	− 25
Vacum cleaners, etc.	88*	− 57
Insulating tubes	93	− 73
From United States	76	− 76
„ Canada	1	− 9
„ Argentina	15	+ 15
Fans	23*	− 27
Refrigerators and parts	274	− 946
From Argentina	30	+ 24
„ United States	242	− 972
Fractional HP motors	78*	— 69
Dynamos and spare parts	181	− 4
From Great Britain	1	− 12
„ United States	160	+ 2
„ Switzerland	20	+ 8

*Mainly from U.S.A.

ELECTRICITY SUPPLY

Service to Cottages. North Wales Water Power.

Accrington.—MARKET LIGHTING.—The Markets Committee has asked the borough electrical engineer to execute as soon as possible the work of re-wiring the Market Hall basement at a cost of nearly £500. The scheme provides for the abolition of all overhead cables, the placing underground of all the feeder cables for the outside market and supplying various points.

Axbridge (Somerset).—TOO COSTLY.—Comments were made at a meeting of the Rural District Council on the cost of arranging for a supply to agricultural workers' cottages at East Brent. The Finance and General Purposes Committee had recommended that this expenditure should not be entertained at the present time, and Mr. E. F. Tilley asked if this meant that the cottages would be without electric lighting. Mr. A. E. Dibble stated that electricity was available but the Council was not prepared to pay the price quoted for bringing it to the cottages. Mr. Tilley asked whether the supply company could be persuaded to modify its terms; agricultural workers deserved and should get as good a class of house as urban workers and as the mains were so close no effort should be spared to obtain the service.

In the opinion of Mr. A. E. Burnett there was much discontent among people who resided in the country at their inability to obtain electricity. When the grid system was introduced it was thought that everyone would be able to have electric lighting; pylons carried the mains past villages which were still without electricity. He thought that there would shortly be a national inquiry regarding electricity and considered that it would be as well to let the matter rest until the inquiry had been held. Mr. Dyer, however, was of the opinion that an inquiry was unlikely to be held in the near future as it was the Government's policy to get people to reduce their consumption.

After further discussion it was decided to refer the matter to the Civil Defence Committee.

Cardiff.—FACTORY SUPPLY.—The Electricity Committee is to install equipment at a cost of £2,000 in connection with a factory bulk supply.

Hove.—ABOLITION OF MINIMUM CHARGE.—It is recommended that the minimum charge shall be abolished as from January 1st. The charge in force hitherto has been £1 per annum, which under the Minister of Fuel's amending Order would have been reduced to 10s.

Lichfield.—CONCESSION REPEATED.—The Electricity Committee recommends that the wartime increase of 10 per cent., in charges shall not be enforced for the quarters ending December 31st and March 31st. The additional charge was waived throughout last year.

Lytham St. Annes.—PRICE INCREASE.—The wartime addition to electricity charges, hitherto 10 per cent., is to be increased to 15 per cent.

Northern Ireland.—LOWER CHARGES.—The *Belfast News-Letter* reports that charges for electricity for lighting and heating are to be reduced by the Northern Ireland Electricity Board as from March 1st. Details of the reductions are as follows :—Quarterly consumers' accounts, increase of 10 per cent. in charges reduced to 5 per cent.; two-part tariff prepayment charges, increase of 10 per cent. reduced to 5 per cent.; flat rate prepayment charges, meter rental of 5s per annum reduced to 3s. per annum; fixed minimum annual charges of 25s. and 30s. withdrawn.

North Wales.—WATER POWER INVESTIGATIONS.—Hydro-electric development in North Wales after the war, possibly on the model of the Scottish Highlands scheme, was foreshadowed by Mr. G. Rankin, general manager of the North Wales Power Co., at Llandudno last Friday. He said that more electricity was generated by water power last year in North Wales than ever before. Ideas put forward by members of the North Wales Joint Electricity Authority were being investigated and a preliminary survey was being made with the object of finding suitable catchment areas. Mr. George Wright, of the Cheshire County Council, advocated the harnessing of the river Conway; and Mr. Rankin said that this scheme was one of many being considered by his company.

Scarborough.—LOAN.—The Electricity Commissioners and the Treasury have sanctioned the borrowing of £1,618 to defray the balance of the cost of modifications to the 11-kV system at the generating station.

York.—NEW SUBSTATION.—The Electricity Committee is seeking sanction to borrow £1,200 for a substation.

TRANSPORT

Fort William.—PROPOSED MOUNTAIN RAILWAY.—Construction of an electric railway to the summit of Ben Nevis was suggested at a meeting of the Fort William Town Council as a scheme for post-war development. Supporting the proposal, the Provost said that industry and the tourist trade could develop side by side in Lochaber. The proposal is to be brought to the notice of the Secretary of State for Scotland.

France.—PARIS TROLLEY-BUSES.—Last year trolley-buses were introduced on the Porte de Champerret—Bezons route, Paris, which had previously been served by petrol buses and then by vehicles driven by town gas. According to the *Transport World*, the new trolley-buses are of the single-deck type. The driving unit is one compound-wound motor with a continuous rating of 60 kW at 550 V. A speed of 50 km. per hr. can be attained on the level, the loaded weight being calculated at 10 tons. Regenerative braking is employed down to a speed of 18 km. per hr. A petrol-driven engine and generator are installed in a compartment at the rear of the vehicle for manœuvring where overhead-line contact is interrupted. This generator has a capacity of 16 kW at 200 V and can operate the vehicle at 11 km. per hr.

Tees-side.—CO-ORDINATION PLAN.—The officials of Middlesbrough and Stockton transport undertakings and the Tees-side Railless Traction Board are to prepare a report on the amalgamation or co-ordination of transport services.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The Westinghouse Brake & Signal Co., Ltd., is increasing its cash bonus from 2½ to 4 per cent. and is maintaining its first and final dividend at 10 per cent., making a total distribution of 14 per cent. (against 12½ per cent.). After provision for taxation, which may be subject to adjustment, the net profit for the year ended September 30th is £173,274, an increase of £8,563. Adding £95,836 (£91,273) brought in there is £269,110 (£255,984) available. Staff pensions take £15,000 (£10,000), contingencies £80,000 (same) and dividend and cash bonus £78,566 (£70,148), leaving £95,544 to be carried forward.

The Carrier Engineering Co., Ltd., records a trading profit for the year ended June 30th last amounting to £94,862, which compares with £98,933 in the previous year. Adding investment income, etc., the profit balance is £99,161 (£103,414). Patent fees absorb £232 (£297), depreciation £9,232 (£15,948) and taxation £29,194 (£22,569), leaving a net profit of £60,503 (£67,600). Preference dividends take £4,466, and an ordinary dividend of 25 per cent. (same) (paid December 17th) absorbs £42,187 (£37,500). It is not proposed to pay any further ordinary dividend for 1942-43. After transferring £10,000 (nil) to reserve, £107 400 (£103,552) is carried forward.

The Ship Carbon Co. of Gt. Britain, Ltd. (in which the Morgan Crucible Co. holds an interest) reports a profit of £152,852 for 1942-43 (against £150,389) to which is added £9,535 brought forward and £6,556 tax reserve no longer required. Income tax and E.P.T. provision absorbs £134,100 and £6,556 (against £11,500) is transferred to general reserve. After paying an ordinary dividend of 10 per cent. (against nil), £10,437 is carried forward.

At the annual meeting a resolution will be put forward for the conversion of the ordinary and preference shares into stock, after the consolidation of the 5s. ordinary shares into £1 shares.

The Power Corporation of Canada is to defer payment of a dividend on the common shares pending clarification of the position with regard to taxation. For 1942-43 30 cents per share was paid.

Bennis Combustion, Ltd., have declared an interim dividend of 5 per cent., the same as last year. A dividend of 10 per cent. was paid for the full year.

New Companies

Electric Machinery Co. (Manchester), Ltd.—Private company. Registered January 12th. Capital, £6,500. Objects: To acquire the business of the Electric Machinery Co., carried on at New Islington, Manchester, and to carry on the business of manufacturers and repairers of, and dealers in, dynamos, batteries and electrical plant and appliances, etc. Directors: S. R. Thomson, 26, Stanley Park, Litherland, Liverpool; W. A. Gale, 33, Sefton Road, Litherland; A. Smith, Beverley, Beaconsfield, Bucks; D. W. Thomson, 52, Litherland Park, Litherland; and A. Wyatt, Litherland Park, Litherland. Registered office: New Union Works, New Islington, Ancoats, Manchester.

Sturtevant Pension Trustees, Ltd.—Private company. Registered January 8th. Capital, £100. Objects: To act as trustees of any scheme for providing pensions and other benefits for employees of the Sturtevant Engineering Co., Ltd., or subsidiary or associated company, and in particular the Sturtevant Engineering Co., Ltd., Staff Superannuation Scheme. Subscribers: G. R. Thursfeld, 30, Cheyne Walk, S.W.3; W. Gwilt, 2, Algernon Road, S.W.13; C. H. Harris, 14, Green Lane, Purley; and A. C. D. Miller, 2, Greenhalgh Walk, Hampstead Garden Suburb, N.2. Secretary: N. L. Millard.

Dale Electronics, Ltd.—Private company. Registered January 12th. Capital, £2,000. Objects: To carry on the business of electrical, mechanical and chemical engineers, manufacturers of, and dealers in, telegraphic, telephonic, radio, photographic and motor goods, apparatus and accessories, proprietors and managers of cinemas, theatres and halls, etc. Directors: D. D. Wedderspoon, 13, Tretawn Gardens, N.W.7; and Harry Everett, 49, Warbaum Court Road, Carshalton Beeches, director of Portland Radio Co., Ltd. Registered office: 152/6, Great Portland Street, W.1.

Gee's Radio & Electrical Stores, Ltd.—Private company. Registered January 12th. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, wireless sets and valves, gramophones, television sets, electrical apparatus, etc. Subscribers: A. Chapper, 29, Bocking Street, E.8; M. S. Gee, 16, Lewis Flats; and B. L. Silver, 62, Nightingale Road, E.5. Registered office: 213, Lower Clapton Road, E.5.

Sharp Control Gear, Ltd.—Private company. Registered December 31st. Capital, £1,000. Objects: To carry on the business of electrical, mechanical and general engineers, etc. First directors: W. Sharp and Mrs. V. L. Sharp, both of 258, Pershore Road South, King's Norton, Birmingham. Registered office: 10a, Camp Lane, King's Norton, Birmingham 30.

Leslie A. Warriss, Ltd.—Private company. Registered January 7th. Capital, £1,000. Objects: To carry on the business of electricians, radio and electrical engineers, experts and contractors, wire makers, manufacturers of, and dealers in, gramophones, etc. Directors: L. A. Warriss, 204, Lichfield Court, Sheen Road, Richmond, Surrey; and G. W. Norman, 15, Pembridge Crescent, W.11, director of Frankous, Ltd. Registered office: 9, Lichfield Terrace, Richmond.

L. C. Mitchell & Co. (Gloucester), Ltd.—Private company. Registered January 7th. Capital, £10,000. Objects: To carry on the business of electricians, electrical contractors, wireless engineers and dealers, etc. Directors: L. C. Mitchell, Gartage Hall, Hucclecote, Gloucester;

and B. C. Mitchell, 48, Kendal Road, Gloucester. Secretary: H. L. Large. Registered office: 52, Northgate Street, Gloucester.

British Industrial Engineering Co. (Wolverhampton), Ltd.—Private company. Registered January 1st. Capital, £2,000. Objects: To carry on the business of general and refrigeration construction engineers, tool makers, motor, electrical, marine, civil and consulting engineers, etc. Directors: S. Gittins, 5, Coalway Avenue, Wolverhampton; G. F. Jonas, 13, Burnham Avenue, Oxley, Wolverhampton; and J. B. Rodger, 53, Lincoln Road, Walsall. Registered office: 31, Queen Street, Wolverhampton.

Brighton Trade Services, Ltd.—Private company. Registered January 11th. Capital, £2,000. Objects: To carry on the business of electricians, electrical, radio, motor and general engineers, etc. Permanent directors: G. E. Robson, 57, Dale Crescent, Patcham, Brighton; and J. E. Hay, Tudor Cottage, Preston Road, Brighton. Registered office: 2, Marshall's Row, Brighton, Sussex.

Bev-Gree, Ltd.—Private company. Registered January 5th. Capital, £500. Objects: To carry on the business of manufacturers of, and dealers in, radio and electrical apparatus, general engineers, etc. Directors: E. E. Bevan and Mrs. Bevan, both of 47, Chesington Road, Henleaze, Bristol; and A. R. Greet, 6, Shaftesbury Avenue, Montpelier, Bristol. Registered office: 25, Jamaica Street, Bristol, 2.

Wishaw Jig & Tool Co., Ltd.—Private company. Registered in Edinburgh January 7th. Capital, £10,000. Objects: To carry on the business of mechanical and electrical engineers, electricians, motor and marine engineers, etc. Subscribers: W. B. Hardie, solicitor and J. Tindal, both of 113, St. Vincent Street, Glasgow.

Companies' Returns

Statements of Capital

John Adams, Ltd.—Capital, £7,000 in 6,000 preference and 1,000 ordinary shares of £1. Return dated August 10th. 2,700 preference and 300 ordinary shares taken up. £3,000 paid. Mortgages and charges: Nil.

Mansbridge Condenser Co., Ltd.—Capital, £25,000 in £1 shares. Return dated October 14th. All shares taken up. £10,000 paid. £15,000 considered as paid. Mortgages and charges: Nil.

C. F. Casella & Co., Ltd.—Capital, £17,000 in 15,000 ordinary and 2,000 preference shares of £1. Return dated October 23rd. 12,204 ordinary and 2,000 preference shares taken up. £3,504 paid. £10,700 considered as paid. Mortgages and charges: Nil.

Telephone Manufacturing Co., Ltd.—Capital, £500,000 in 2,000,000 ordinary shares of 5s. Return dated July 26th (filed October 14th). 1,540,000 shares taken up. £201,562 10s. paid (6s. 9d. on 200,000, 7s. 6d. on 240,000 and 8s. 9½d. on 100,000 shares). £250,000 considered as paid on 1,000,000 shares. Mortgages and charges: Nil.

Dubilier Condenser Co. (1925), Ltd.—Capital, £500,000 in 500,000 preference shares of 10s. each and 5,000,000 ordinary shares of 1s. each. Return dated August 26th (filed September 10th). 200,000 preference and 1,539,375 ordinary shares taken up. £176,968 15s. paid. Mortgages and charges: Nil.

New System Private Telephones, Ltd.—Capital, £20,000 in £1 shares. Return dated July 26th. All shares taken up. £33,000 paid (£1 on 13,000 shares and £4 (£3 premium) on 5,000 shares). £2,000 considered as paid on 2,000 shares. Mortgages and charges: Nil.

Ernest Jones (Bradford), Ltd.—Capital, £3,000 in £1 shares (all ordinary). Return dated August 2nd. 1,473 shares taken up. £1,473 paid. Mortgages and charges: Nil.

Stearn Electric, Ltd.—Capital, £4,000 in £1 shares. Return dated November 10th. All shares taken up. £2 paid. £3,998 considered as paid. Mortgages and charges: £18,200.

Pirelli, Ltd.—Capital, £400,000 in £1 shares. Return dated December 1st. All shares taken up. £400,000 paid. Mortgages and charges: £150,000.

Increase of Capital

Anglo-American Electrical Appliances, Ltd.—The nominal capital has been increased by the addition of £900, in £1 ordinary shares, beyond the registered capital of £100.

Mortgages and Charges

Spicers (Electrical), Ltd.—Mortgage on land and premises in Alexandra Road, Hounslow, dated December 16th, 1943, to secure £2,000. Holders: Mrs. Olive M. Gardener, 188, Jersey Road, Osterley, Isleworth; and Percy G. Gardener, 295, High Street, Hounslow.

Dowsing Radiant Heat Co., Ltd.—Satisfaction in full on July 31st, 1943, of mortgages dated September 29th and registered October 11th, 1932. (Notice filed January 6th.)

York Shipley, Ltd.—Assignment of contract moneys, dated December 20th, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Receiver Appointed

Accumulators "Elite," Ltd.—Miss Eveline Rhodes, 94, Rochdale Road, Ripponden, near Halifax, was appointed receiver (in place of Edgar Sproat) on December 28th, under powers contained in debenture dated July 29th, 1936.

Liquidations

Gollings & Ayres, Ltd.—Meeting February 18th, at 7, St. Paul's Square, Bedford, to receive an account of the winding up by the liquidator, Mr. C. E. V. Salsbury.

Bankruptcies

S. Mendelson, trading as Mendelson & Co., wholesale radio and electrical factors and importers, 12A, Church Gate, Leicester.—Order made December 9th, suspending bankrupt's discharge for eighteen months until June 9th, 1945.

H. C. Casselden, trading as Edwards & Son, radio, electrical, etc., dealer, 67, London Road, Brighton. Last day for receiving proofs for dividend January 21st. Trustee, Mr. A. E. Orbell, 6-7, Old Steine, Brighton.

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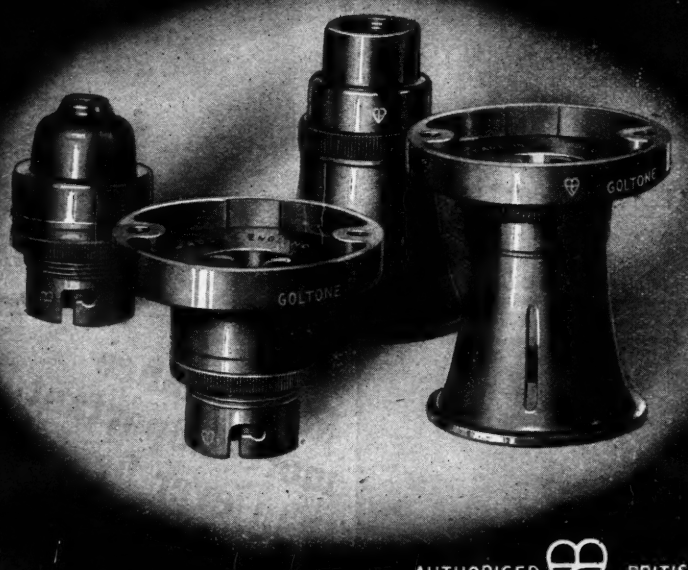

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ESTABLISHED HALF A CENTURY

STOCKS AND SHARES

TUESDAY EVENING.

STOCK Exchange markets and prices are moving quietly. There is not a great deal of business going on in any of the markets. Payment of taxes is given as one of the reasons for the contraction of activity amongst gilt-edged and kindred securities. The air of expectation with which the war developments are regarded is assumed to be another of the factors that make for quietude in the Stock Exchange. Prices are well maintained; on balance, the movements are in favour of present holders. No difficulty is experienced in disposing of good-class stock and shares when these come in for sale. In spite of the caution which characterises financial enterprise, Stock Exchange brokers are well aware of the ease with which sound securities can be placed, and, as a natural corollary, the difficulty of obtaining sizeable amounts of investments of high standing that pay a reasonable rate of interest upon money employed in them.

Home Electricity Supply

The prices of electricity supply shares hold their ground with a firmness the more noteworthy because of the high level at which the shares now stand. Yorkshire Electrics, for example, cannot be bought under 43s, Metropolitans cost 42s., Northmet ordinary 38s. 6d. and Clyde Valley 42s. 6d., prices which, on the present-paid dividends of 8 per cent. in each case, give a return of about 3¾ per cent. The companies are known to have been affected in their profits by high working costs and the price of coal. It is true that some of them have been allowed to make modest additions to their bills, but the advance in the rates charged to customers is hardly likely to cover the extra expenditure which the companies have incurred by reason, mainly, of war conditions.

Dividend Discussions

As already mentioned, the Home electricity supply companies' dividends for the year 1943 will be announced within the next few weeks, and anticipation looks—at present—for maintenance of the previously-paid rates. No great surprise would be felt, however, if, in the case of some of the present 8 per cent. dividends, there should be a reduction to 7½ per cent. for the full year, although no doubt the companies will do their best to repeat, for 1943, the dividends previously distributed. All the good companies had substantial cash reserves, and it is possible that these are being utilised to keep the dividends up to their pre-war standard. Proprietors of Home electricity supply shares seldom part from them, save under exceptional circumstances, although the present quotations, taken in conjunction with the outlook, appear to offer little scope for appreciation in capital value. Electric Supply Corporation, Electrical Finance & Securities and London Associated ordinary shares are all 1s. better. Edmundsons' have hardened to 29s., and several others also have risen 6d.

Transport "C"

Advance guesses look for the dividend on Transport "C" stock to be 3 per cent., the same as it was a year ago. This gives a yield of no more than £4 11s. per cent. on the money, against 7¼ per cent. that can be obtained from London Midland & Scottish ordinary, and 7⅛ per cent. from Great Western ordinary at the current prices. The prospect of Transport "C" stock receiving substantially higher dividends after the war is, of course, responsible for the comparatively high price. Optimism looks for anything between 4 and 5 per cent. to be declared a year or two after the Armistice. The Southern Railway, it is taken for granted, will again pay 5 per cent. on its preferred ordinary stock and, if this materialises, the yield will be 6½ per cent. on the money. The dividend will be announced on February 17th. The London Transport declaration is due on the same day.

Price Movements

Johnson and Phillips shares are a good market; at 68s. the price is 1s. up. Revo have risen to 39s., Telegraph Constructions to 50s. 6d. Crabtrees are harder at 37s. 3d. and British Vacuum Cleaners at 27s. 6d. Some of the "heavy industry" shares have been in demand: Babcock & Wilcox at 49s. 6d. are 9d. to the good. Amongst Indian shares, Calcutta Electric Supply stand out with a florin rise to 37s. and Calcutta Trams at a similar price are 1s. up. Argentine stocks have weakened; the Anglo-Argentine Tramways group is lower. Brazilian Tractions at 26 have fallen a point. In the communications group, Anglo-American stocks are better, the preferred and deferred being a point higher at 115½ and 29 respectively. The deferred, it seems anomalous to remark, now yields a shade less than the preferred. Cable & Wireless stocks are dull. Canadian Marconis put on 1s. to 9s, on talk of a possible increase in the dividend. De la Rue change hands fairly frequently on the basis of £8. Dictograph Telephones, florin shares, are 3d. up at 3s. 6d.

Wireless and Films

Activity in the radio and cinema group has subsided to some extent, but a good deal of interest is still being taken in the shares of the popular companies. E.M.I., after easing off a trifle, rallied to the previous price of 28s., Cossor at 22s. 6d. hold their recent

(*Continued on page* 105)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend: Previous	Dividend: Last	Middle Price Jan. 18	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	61/6	..	4 2 0
British Power and Light	6	7	32/6	..	4 6 2
City of London	7	7	28/–	..	5 0 0
Clyde Valley	8	8	42/–	..	3 16 0
County of London Edmundsons:	8	8	41/–	..	3 18 0
7% Pref.	7	7	34/–	..	4 2 4
Ord.	6	6	29/–	+6d.	4 2 9
Elec.Dis.Yorkshire	9	9	44/–	..	4 1 10
Elec. Fin. and Securities	12½	12½	54/6	+1/–	4 11 9
Elec. Supply Corporation	10	10	47/–	+1/–	4 5 0
Isle of Thanet	Nil	Nil	18/–	..	—
Lancs. Light and Power	7½	7½	35/6	..	4 4 6
Llanelly Elec.	5½	6	25/–	..	4 16 0
Lond.Assoc.Electric	4	3	24/–	+1/–	2 10 0
London Electric	6	6	28/–	+6d.	4 5 9
LondonPowerRed. Deb.	5	5	104½	..	4 15 7
Metropolitan E.S.	8	8	41/6	..	3 17 0
Midland Counties	8	8	39/6	+6d.	4 1 1
Mid. Elec. Power	9	9	43/–	+6d.	4 3 9
Newcastle Elec.	7	7	31/–	..	4 10 5
North Eastern Elec.: Ordinary	7	7	32/6	..	4 6 2
7% Pref.	7	7	34/6	..	4 1 2
Northampton	10	10	48/–	..	4 3 4
Notting Hill 6% Pref. (£10)	6	Nil	10	..	—
Northmet Power: Ordinary	7	7	38/–	..	3 13 8
6% Pref.	6	6	30/6	..	3 18 8
Richmond Elec.	6	6	26/–	..	4 12 4
Scottish Power	8	8	40/–	..	4 0 0
Southern Areas	5	5	22/6	..	4 9 0
South London	7	7	27/–	..	5 3 8
West Devon	5	5	23/6	..	4 5 0
West Glos.	4½	3½	24/–	..	2 18 4
Yorkshire Elec.	8	8	42/6	..	3 15 3
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	6/6	−3d.	—
Calcutta Elec.	7*	6*	37/–	+2/–	3 10 2
Cawnpore Elec.	10	10	35/–	..	5 14 3
East African Power	7	7	33/–	..	4 4 10
Jerusalem Elec.	7	5	28/6	..	3 10 2
Kalgoorlie (10/–)	5	5	10/–	..	5 0 0
Madras Elec.	4*	Nil	23/6	..	—
Montreal Power	1½	1½	21	..	6 19 6
PalestineElec."A"	4*	5*	40/3	..	2 9 10
Perak Hydro-elec.	6	7	10/–	..	—
Shawinigan Power	83cts.	90cts.	16	..	—
Tokyo Elec. 6%	6	6	18	..	—
VictoriaFallsPower	15	15	4¾	..	3 8 7
Whitehall Inv.Pref.	—	—	24/–	..	4 3 4

Company	Dividend: Previous	Dividend: Last	Middle Price Jan. 18	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity: 1955–60 (Civil Defence)	—	3	100	..	3 0 0
1955–75	5	5	115	..	4 7 0
1951–73	4½	4½	107	..	4 4 1
1963–93	3½	3½	102½	..	3 8 4
1974–94	3½	3½	100	..	3 5 0
LondonElec.Trans. Ltd.	2½	2½	97	..	2 11 3
London & Home Counties1955–75	4½	4½	112	..	4 0 4
Lond.Pass.Trans.: A	4½	4½	119½	..	3 15 4
B	5	5	119½	..	4 3 8
C	2⅞	3	66	+1	4 11 0
WestMidlandsJ.E.A. 1948–68	5	5	109	..	4 11 9
Telegraph and Telephone					
Anglo-Am. Tel.: Pref.	6	6	115½	+1	5 4 0
Def.	1½	1½	29	+1	5 3 5
Anglo-Portuguese	8	8	24/–	..	6 13 4
Cable & Wireless: 5½ Pref.	5½	5½	113	−½	4 17 4
Ord.	4	4	78½	−½	5 2 0
CanadianMarconi$1	Nil	4cts.	9/–	+1/–	—
Globe Tel. & Tel.: Ord.	8½*	5*	37/6	..	2 13 4
Pref.	6	6	30/–	..	4 0 0
Great NorthernTel. (£10)	Nil	Nil	22½	..	—
Inter. Tel. & Tel.	Nil	Nil	15	..	—
Marconi-Marine	7½	7½	32/3	..	4 13 0
Oriental Tel. Ord.	16	10	45/–	..	—
Telephone Props.	6	Nil	17/6	..	—
Tele.Rentals(5/–)	10	10	11/6	..	4 7 0
Traction and Transport					
Anglo-Arg.Trans.: First Pref. (£5)	Nil	Nil	2/6	−6d.	—
4% Inc.	Nil	Nil	7	−1½	—
Brit.Elec.Traction: Def. Ord.	45	45	1085	..	4 2 7
Pref. Ord.	8	8	175	..	4 11 5
Bristol Trams	10	10	52/–	..	3 17 0
Brazil Traction	$1	$1½	26	−1	6 13 0
Calcutta Trams.	5½	6½	37/–	+1	3 10 5
Cape Elec. Trams	5	6	24/–	..	5 0 0
Lancs. Transport	10	10	44/3	..	4 10 4
Mexican Light: 1st Bonds	5	5	102½	−1	4 17 7
Rio 5% Bonds	5	5	105½	..	4 14 9
Southern Rly.: 5% Prefd.	5	5	77	..	6 9 7
5% Pref.	5	5	117	+½	4 5 6
T. Tilling	10	10	54/6	..	3 13 3
West Riding	10	10	44/–	..	4 11 0

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Jan. 18	Rise or Fall	Yield p.c.
Equipment and Manufacturing					£ s. d.
Aron. Elec. Ord. .	10	15	55/–	..	5 9 1
Assoc. Elec. :					
Ord.	10	10	50/6	..	3 19 0
Pref.	8	8	38/6	..	4 3 1
AutomaticTel.&Tel.	12½	12½	57/–	..	4 7 8
Babcock & Wilcox	11	11	49/6	+9d.	4 9 0
British Aluminium	10	10	47/6	..	4 4 0
British Insul. Ord.	20	20	5 7/16	..	3 13 4
British Thermostat (5/–)	18½	18½	19/–	..	4 17 4
BritishVac.Cleaner (5/–)	15	30	27/6	+6d.	5 9 1
Brush Ord. (5/–)	6	8	8/6	..	4 14 2
Burco (5/–) ..	15	17½	15/3	..	5 14 9
Callender's	15	20	99/–	..	4 1 0
Chloride Elec. Storage	15	15	80/–	..	3 15 0
Cole, E. K. (5/–)	10	15	26/–	..	2 17 10
Consolidated Signal	17	24	6	+¾	4 0 0
Cossor, A. C. (5/–)	7½*	10*	22/6	..	2 5 6
Crabtree (10/–) ..	17½	17½	37/3	+6d.	4 14 1
CromptonParkinson Ord. (5/–) ..	20	22½	27/–	..	4 3 4
E.M.I. (10/–) ..	6	8	28/–	..	2 17 2
Elec.Construction	10	12½	50/6	..	4 19 0
Enfield Cable Ord.	12½	12½	59/–	..	4 4 8
English Electric. .	10	10	48/6	..	4 2 6
EnsignLamps(5/–)	25	15	20/–	..	3 15 0
Ericsson Tel. (5/–)	22*	20*	51/3	..	1 19 0
Ever Ready (5/–)	40	40	39/–	..	5 2 7
Falk Stadelmann	7½	7½	32/6	..	4 12 4
Ferranti Pref. ..	7	7	29/6	..	4 15 0
G.E.C. : Pref.	6½	6½	32/6	..	4 0 0
Ord.	17½	17½	89/6	..	3 18 2
Greenwood&Batley	15	15	41/3	..	7 5 9
HallTelephone(10/–)	12½	12½	25/6	..	4 18 1
Henley's (5/–) ..	20	20	25/–	..	4 0 0
4½% Pref. ..	4½	4½	23/–	..	3 18 3
Hopkinsons ..	15	17½	60/–	..	5 16 8
India Rubber Pref.	5½	5½	21/6	..	5 2 4
Intl. Combustion	30	30	6½	..	4 16 0
Johnson & Phillips	15	15	68/–	+1/–	4 8 3
LancashireDynamo	20	22½	92/–	..	4 18 6
Laurence,Scott(5/–)	12½	12½	13/–	..	4 16 2
London Elec. Wire	7½	7½	34/6	..	4 7 0
Mather & Platt ..	10	10	52/6	+6d.	3 16 2
Metal Industries(B)	5	8	44/3	..	3 12 2
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Murex	20	20	100/–	..	4 0 0
Pye Deferred (5/–)	25	25	26/3	..	4 15 3
Revo (10/–) ..	17½	17½	39/–	+3d.	4 9 6
Reyrolle ..	12½	12½	70/–	..	3 11 5
Siemens Ord. ..	7½	7½	33/–	..	4 11 0
Strand Elec. (5/–)	7½	10	7/9	..	6 9 0
Switchgear&Cowans (5/–) ..	10	20	18/–	..	5 11 1
T.C.C. (10/–) ..	5	5	18/9	..	2 13 4
T.C. & M. ..	10	10	50/6	+6d.	3 19 2
TelephoneMfg.(5/–)	9	9	11/–	..	4 1 10
Thorn Elec. (5/–)	20	20	22/3	..	4 11 0
Tube Investments	20	20	94/–	..	4 5 1
Vactric (5/–) ..	Nil	Nil	14/–	−3d.	—
Veritys (5/–) ..	7½	7½	7/3	..	5 3 5
Vickers (10/–) ..	10	10	17/6	..	5 14 3
WalsallConduits(4/–)	55	55	45/–	..	4 17 9
Ward & Goldstone (5/–)	20	20	27/3	..	3 13 5
WestinghouseBrake	12½	14	70/–	+5/–	4 0 0
West, Allen (5/–)	7½	7½	6/9	..	5 11 2

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page* 103)

advance and E. K. Cole remain unchanged at 26s. Speaking in a recent broadcast, Mr. Arthur Rank, who is regarded as one of the foremost men in the film industry, predicted a very great future for television, although he did not think it was going to knock out the film. Television might result in an entirely new kind of film-making. His broadcast amplified the view expressed by the Prime Minister some time ago when he said that, after the war, television would be one of the expanding industries.

Westinghouse Brake

Westinghouse Brake shares have risen 5s. on an increase in the dividend. It may be recalled that for the previous twelvemonth the dividend was 10 per cent., at which it stood for three years. The rise to 12½ per cent. in respect of 1942 is followed by a further advance to 14 per cent., of which 4 per cent. is announced as bonus, this being in accordance with the practice adopted before the war, when annual bonuses ranging from 5 to 7½ per cent. were paid. The latter, making 17½ per cent. in all, was distributed for 1937, in which year the price rose to 78s. 6d. Since then, it has been down to 30s., in 1940. To-day it stands at 70s., giving at that price a yield of 4 per cent. on the money. The dividend of 14 per cent. is comfortably paid, the company's earnings being sufficient to pay twice as much.

Consolidated Signal

The rise in Westinghouse Brakes has led to a corresponding improvement in the shares of the Consolidated Signal Co., which owns £391,000 of Westinghouse Brake stock, practically one third, of the total amount in issue. The Consolidated Signal Co. raised its dividend last year from 17 per cent. to 24 per cent. and the price of the shares is now £6, showing a gain of 7s. 6d. on the week. Going back seven years, the company paid, in 1937, 36½ per cent., and the shares in that year rose at one time to 150s., from which there was a decline to 60s. in 1941. Anticipation looks for a further increase in the Consolidated Signal dividend in view of the improvement in the Westinghouse Brake distribution. In strict proportion, the Consolidated Signal dividend should be 27½ per cent.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specifications (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

ACME Wringers, Ltd., and J. Tennent and D. C. Ross (both legal representatives of J. W. Burt).—"Power-driven wringers." 7298. May 29th, 1942. (558357.)

Aktiebolaget Elektrolux.—"Absorption refrigerating apparatus." 12228/42. September 22nd, 1941. (558338.)

Allmänna Svenska Elektriska Aktiebolaget.—"Rectifier connection." 8718/42. July 11th, 1941. (558269.)

A. C. Anselmi.—"Electric soldering irons." 10275. July 22nd, 1942. (558366.)

Birmingham Electric Furnaces, Ltd., and A. G. E. Robiette.—"Electric induction furnaces." 17240. October 20th, 1943. (558382.)

E. W. Bliss Co.—"Mechanisms for operating electric switches." 13002/42. December 26th, 1941. (558280.)

British Thomson-Houston Co., Ltd.—"Electric lamp sockets." 11568/42. August 26th, 1941. (558244.) "Electric protective systems of the differential type." 10348/42. July 25th, 1941. (558304.) "Methods of producing solids of desired configuration, for example, a smooth covering layer on the fluorescent screen of a television picture tube, or a mould for reproducing the shape of a snowflake." 8603/42. June 27th, 1941. (558323.) "Washing machines." 2965/42. March 8th, 1941. (558350.)

British Thomson-Houston Co., Ltd. (General Electric Co.).—"Electric devices having an enclosing envelope." 9631. July 10th, 1942. (558336.)

British Thomson-Houston Co., Ltd., and J. Dyson.—"Protective circuits for rectifiers." 14820. October 22nd, 1942. (558345.)

British Thomson-Houston Co., Ltd., and G. A. Freeman.—"Magneto-electric ignition apparatus." 11604. August 18th, 1942. (558245.)

British Thomson-Houston Co., Ltd., and B. G. Higgins.—"Alternating current control arrangements." 14415. October 14th, 1942. (Addition to 528247.) (558341.)

Cinema-Television, Ltd. (C. S. Szegho.).—"Cathode ray tubes." 11356. August 13th, 1942. (558241.)

E. S. Conradi.—"Portable electric hand lamps." 8550. (June 22nd, 1942. (558226.)

Contactor Switchgear, Ltd., and H. Rayner.—"Electromagnetic switches." 15049. October 27th, 1942. (558348.)

English Electric Co., Ltd., and M. A. B. Landers.—"Fusible cut-outs." 11436. August 14th, 1942. (558369.)

Ericsson Telephones, Ltd., B. O. Anson and S. H. D. Ward.—"Lightning arrestors and electrodes therefor." 13034. September 16th, 1942. (558281.)

Evans Electroselenium, Ltd., G. A. Veszi and P. Markus.—"Photo-electric cells." 10081. July 20th, 1942. (558300.)

A. E. House.—"Welding methods and apparatus therefor." 15048. October 27th, 1942. (558347.)

J. Howden & Co., Ltd., and W. Nelson.—"Forced draught systems for boiler furnaces." 9599. July 10th, 1942. (558230.)

Igranic Electric Co., Ltd.—"Electric controllers." 10751/42. August 9th, 1941. (558235.)

C. E. P. Jones and R. R. Birss.—"Electric selective signalling and control systems." Cognate applications 8788/42 and 14191/42. June 20th, 1942. (558298.)

W. E. Lord and G. H. Wilkinson.—"Carbon-zinc elements for use in dry cells." 8699. June 25th, 1942. (558292.)

Marconi's Wireless Telegraph Co., Ltd. (Radio Corporation of America).—"Automatic frequency control in electric signalling systems." 8079. June 12th, 1942. (558260.)

R. F. D. Milner.—"Electric cables." 8708. June 25th, 1942. (558325.)

G. F. A. Pigot-Moodie.—"Turbines." 10448. July 27th, 1942. (558367.)

Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken).—"Push-pull mixing circuits for ultra-short waves." 7139. June 5th, 1941. (558253.)

Rediffusion, Ltd., and M. Exwood.—"Receiving systems for modulated electric carrier waves." 13624. September 29th, 1942. (558314.)

Rotax, Ltd., and W. G. Bourne.—"Electric push-button switches." 9011. June 30th, 1942. (558365.)

Rubery Owen Messier, Ltd., and A. Arnot.—"Electric switches sensitive to small operating movements." 5483. April 23rd, 1942. (558257.)

K. H. Schmidt.—"Electrical relays or converters." 3283. March 12th, 1942. (558351.)

Siemens Bros. & Co., Ltd., and H. E. Humphries.—"Electrical counting apparatus." 9973. July 17th, 1942. (558231.)

Standard Telephones & Cables, Ltd.—"Electric wave transmission system." 13168/42. October 31st, 1941. (558311.)

Standard Telephones & Cables, Ltd. (International Standard Electric Corporation).—"Arrangements for controlling electric currents or voltages." 6999. May 22nd, 1942. (558318.) "Pulse modulation communication systems." 14510. October 16th, 1942. (558343.)

Standard Telephones & Cables, Ltd., and A. J. Maddock.—"Electronic switching or keying arrangements." 8478. June 19th, 1942. (558224.)

Standard Telephones & Cables, Ltd., and G. L. Ward.—"Electric soldering apparatus." 8439. June 19th, 1942. (558223.)

Standard Telephones & Cables, Ltd., P. K. Chatterjea, H. Wolfson, D. M. Ambrose and S. C. Shepard.—"Electrical temperature indicators." 8820. June 26th, 1942. (558299.)

P. Stein.—"Remote or local tuning of radio transmitters over broad band widths." 11840. August 22nd, 1942. (558246.)

Stratton & Co., Ltd., and H. A. J. Laughton.—"Instrument panels of radio receiving and transmitting sets." 8668. June 24th, 1942. (558265.) "Mounting and supporting of radio sets in vehicles, aircraft or the like and on wall surfaces." 8669. June 24th, 1942. (558266.)

Veritys, Ltd., and J. W. Forth.—"Electric lamp fittings." 11559. August 18th, 1942. (558308.)

Walsall Conduits, Ltd., and E. Gough.—"Electric tumbler switches." 11480. August 17th, 1942. (558243.)

Wandsworth Electrical Manufacturing Co., Ltd., and T. Batchelor.—"Electric plug and socket couplings." 10234. July 22nd, 1942. (558232.)

Westinghouse Electric International Co.—"Switching systems for electric circuits particularly applicable to resistance welding and high-frequeney heating apparatus." 8627/42. June 24th, 1941. (558359.)

M. Widakowich.—"Contactor convertors." 8570/42. June 20th, 1941. (558358.) "Contactor convertors." 12260/43. June 23rd, 1942. (Divided out of and in addition to 558358.) (558381.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Bootle.—January 29th. Corporation. Electric lamps (reference No. 14), for six or twelve months. Forms of tender, etc., from W. A. Harrison, borough engineer, Town Hall.

Dundee.—January 25th. Corporation. Supply of gas and electrical materials for street and stair lighting. Specifications and forms from T. M. Lappin, public lighting engineer, 1, Lochee Road; tenders to town clerk.

Leeds.—January 24th. Housing Committee. Maintenance repairs for six months for several trades, including that of electrician. Specifications and forms of tender from Mr. R. A. H. Livett, housing director, Priestley House, Quarry Hill, Leeds, 9.

Tottenham.—February 11th. Town Council. Lamps, Schedule No. 20. Forms of tender on application to Mr. E. Townson, town clerk, Tottenham Town Hall, N.15.

Orders Placed

Cardiff.—Electricity Committee. Accepted. Pumping unit (£132).—Harland Engineering Co.

Mansfield.—Health Committee. Accepted. Electric vehicle battery (£166).—Chloride Electrical Storage Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Additions, Oldmill Hospital; T. F. Henderson, city engineer, Town House.

Atherstone.—British Restaurant, Station Street (£2,400); R.D.C. surveyor, 102, Long Street.

Barking.—Nursery for Longbridge and Manor Wards; borough engineer, Barking Town Hall.

Birmingham.—Additions and alterations, Yardley Green Road Sanatorium, including observation ward (£22,679); H. J. Manzoni, city engineer.

Brandon.—British Restaurant, Meadowfield; F. Hedley, U.D.C. Offices, Brandon, Co. Durham.

Cambridgeshire.—Additions at Soham Grammar School (£5,850); county architect, Shire Hall, Cambridge.

Dunfermline.—Hostel for 500 recruits for mining industry; architect, Ministry of Works, Edinburgh.

Essex.—Mixed secondary school, Hornchurch; J. Stuart, county architect, County Hall, Chelmsford.

Faringdon.—Garage, site in Station Road; City of Oxford Motor Services, Ltd., Cowley Road Garage, Oxford.

Fifeshire.—Maternity wing at Adamson Hospital, Cupar (£10,000); Walker & Pride, architects, St. Andrews.

Cooking depot at Dunfermline for Fife County Council (electrical and heating work); George Sandilands, county master of works, County Offices, Wemyssfield, Kirkcaldy.

Guildford.—Buildings at Stoughton Infants' School (£1,040) and canteen at Northmead Boys' School; borough engineer, Municipal Offices, High Street.

Halesowen.—Additions to Hayley Green Hospital for Joint Hospital Board; H. E. Folkes, architect, 34, Hagley Road, Stourbridge.

Hebburn-on-Tyne.—School meals kitchen; J. Dibble, U.D.C. Offices.

Hull.—Hostel for working boys for Society of Sailors' Orphan Homes and Missions; secretary, Cottingham Road.

Leeds.—Community centre, Belle Isle and Middleton Estates, including clinics, baths, library, cinema and shops; W. S. Cameron, city engineer, Civic Hall.

Liverpool.—Workshop building, etc. (£17,971); L. H. Keay, city architect, Blackburn Chambers, Dale Street.

Manchester.—Additions to Crematorium, Chorlton-cum-Hardy; J. H. Sellars & Son, architects, 78, King Street.

Middleton.—Additions; Ashton Smethurst, Ltd., builders, Suffield Street.

Nantwich.—Farm workers' houses at Chorley; A. Bateman, Chorley, Nantwich.

Newcastle-under-Lyme.—Rebuilding Pepper's Grosvenor Garages, London Road; F. Pepper, Wetley Abbey, Wetley Rocks, Stoke-on-Trent.

Northumberland.—Further school canteens (£23,000) and school for the mentally defective at Morpeth; county architect, County Hall, Newcastle-on-Tyne.

Openshaw.—Warehouse, cloth works; W. Blackshaw, architect, Queen's Buildings, St. Peter's Square, Stockport.

Petworth.—School canteens at Ebernoe and Fittleworth; surveyor, Rural Council Offices, Petworth, Sussex.

Reddish.—Works extensions, Rowsley Grove; J. Halden & Co., Ltd., drawing material makers, Rowsley Works.

Rochdale.—Additional municipal offices and police buildings; S. H. Morgan, borough surveyor, Town Hall.
Works canteen, Sumner Street; R. & T. Howarth, Ltd., Builders, Crosfield Works.

Romford.—Establishment of fourth nursery; C. G. Alderton, borough engineer, Romford Town Hall.

Ross and Cromarty.—School canteens at Lochcarron Public School, Plockton H.G. School, and additional facilities at Tain Royal Academy (£1,500); county surveyor, High Street, Dingwall.

Staffordshire.—Police station, Abbots Bromley; E. M. Coombs, county architect, County Buildings, Stafford.

Scarborough.—School kitchen; borough engineer.

Stirlingshire.—Conversion of building for prevocational courses for building industry (£1,500); county architect, Stirling.

Stretford.—Extensions to offices, Trafford Wharf Road; Henry Holt & Son, builders, 7, East Union Street, Manchester, 16.

Sunderland.—Wartime nursery, Margaret Thompson Park (£2,286); borough engineer.

Surrey.—Technical college, Priest Hill Farm, Ewell; county architect, Kingston-on-Thames.

Timperley.—Works additions; W. A. Copley & Sons, Park Road.

Wanstead and Woodford.—Wartime nursery, Grove Lodge Estate, South Woodford (£3,000); R. Trend Binks, town clerk, Municipal Offices, Woodford, E.18.

Wembley.—Building for nursery at Queensbury Square, Kingsbury; C. S. Trapp, borough engineer.

Whitby.—Additions to N.F.S. fire station; divisional officer.

Wolstanton.—Additions, High Street and Silverdale Road; Maiden & Ellis, haulage contractors, Ellison Street, Wolstanton, Staffs.

Forthcoming Events

Institution of Electrical Engineers.—Monday, January 24th, 5.30 p.m. Informal discussion on "Industrial Applications of Radio-Frequency Methods of Heating," to be opened by Mr. N. R. Bligh.

Measurements Section.—Friday, January 21st, 5.30 p.m. "A New Electronic Stabiliser and Regulator for DC Voltages," by Mr. A. Glynne, M.A.

North-Western Centre.—Saturday, January 22nd, 2.30 p.m. Engineers' Club, Manchester. "Economic Rating of Motors and Transformers" and "Economic Flux Density in Large Supply Transformers," by Mr. D. J. Bolton, M.Sc.

Wireless Group.—Friday, January 28th, 6 p.m. Engineers' Club, Albert Square, Manchester. Informal discussion on "Transient Reproduction," to be introduced by Mr. G. I. Thomas.

East Midland Sub-Centre.—Wednesday, January 26th, 2.30 p.m. Loughborough College. "Protection of Structures Against Lightning," by Mr. J. F. Shipley.

North-Eastern Centre.—Monday, January 31st, 6.15 p.m. Neville Hall, Westgate Road, Newcastle-on-Tyne. "Industrial Fire Risks," by Messrs. W. Fordham Cooper and F. H. Mann.

North Midland Students' Section.—Saturday, January 29th, 2.30 p.m. Griffin Hotel, Leeds. "The Cathode Ray Tube and its Applications," by Dr. W. Wilson.

South Midland Students' Section.—Wednesday, January 26th. 6.30 p.m. James Watt Memorial Institute, Birmingham. "Electrical Engineering Research," by Mr. H. W. H. Warren, M.Sc.

Electrodepositors' Technical Society.—Monday, January 31st. Northampton Polytechnic, St. John Street, London, E.C.1. Symposium on "Phosphate Coatings."

Midlands Centre.—Tuesday, February 1st. James Watt Memorial Institute, Birmingham. Discussion on "Electroplating Plant."

Association of Mining Electrical & Mechanical Engineers.—*South Wales Branch.*—Saturday, January 22nd. 5 p.m. South Wales Institute of Engineers, Cardiff. "Some Aspects of Colliery Winding Practice," by Mr. R. W. Worrall, A.M.I.E.E.

Yorkshire North-West Branch.—Saturday, January 22nd, 3 p.m. Hotel Metropole, Leeds. "Pyrotenax Cables," by Mr. Cameron.

British Institution of Radio Engineers.—Thursday, January 27th, 6.30 p.m. Institution of Structural Engineers, 11, Upper Belgrave Street, S.W.1. "Special Electron Tubes," by Mr. F. E. Lane, A.M.I.E.E.

Illuminating Engineering Society.—*Birmingham Centre.*—Friday, January 28th, 6 p.m. Imperial Hotel. "Electric Lighting — a Contractor's Viewpoint," by Mr. J. Ashmore, M.I.E.E.

Institution of Factory Managers.—*South-East (London) Branch.*—Saturday, January 22nd, 2.45 p.m. Bonnington Hotel, Southampton Row, W.C.1. Paper by Mr. A. H. Huckle on "Co-ordination as the Foundation of Factory Management."

Junior Institution of Engineers.—*Midland Section.*—Wednesday, February 2nd, 6.30 p.m. James Watt Memorial Institute, Great Charles Street, Birmingham. "The Development and Administration of a Large Electric Supply Undertaking," by Mr. F. W. Lawton, M.I.E.E., M.I.Mech.E.

Royal Society of Arts.—Wednesday, February 2nd, 1.45 p.m. John Adam Street, Adelphi, London, W.C.2. "Light Alloys in Post-War Britain," by Mr. E. C. Goldsworthy (High Duty Alloys, Ltd.).

North East Coast Institution of Engineers and Shipbuilders.—Friday, February 4th, 6 p.m. Mining Institute, Newcastle-on-Tyne. "The Electrical Equipment of Ships," by Mr. S. Booth.